ORDNANCE

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THE MAGAZINE OF SCIENTIFIC AND INDUSTRIAL PREPAREDNESS

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FOUNDED 1920

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IN THIS ISSUE

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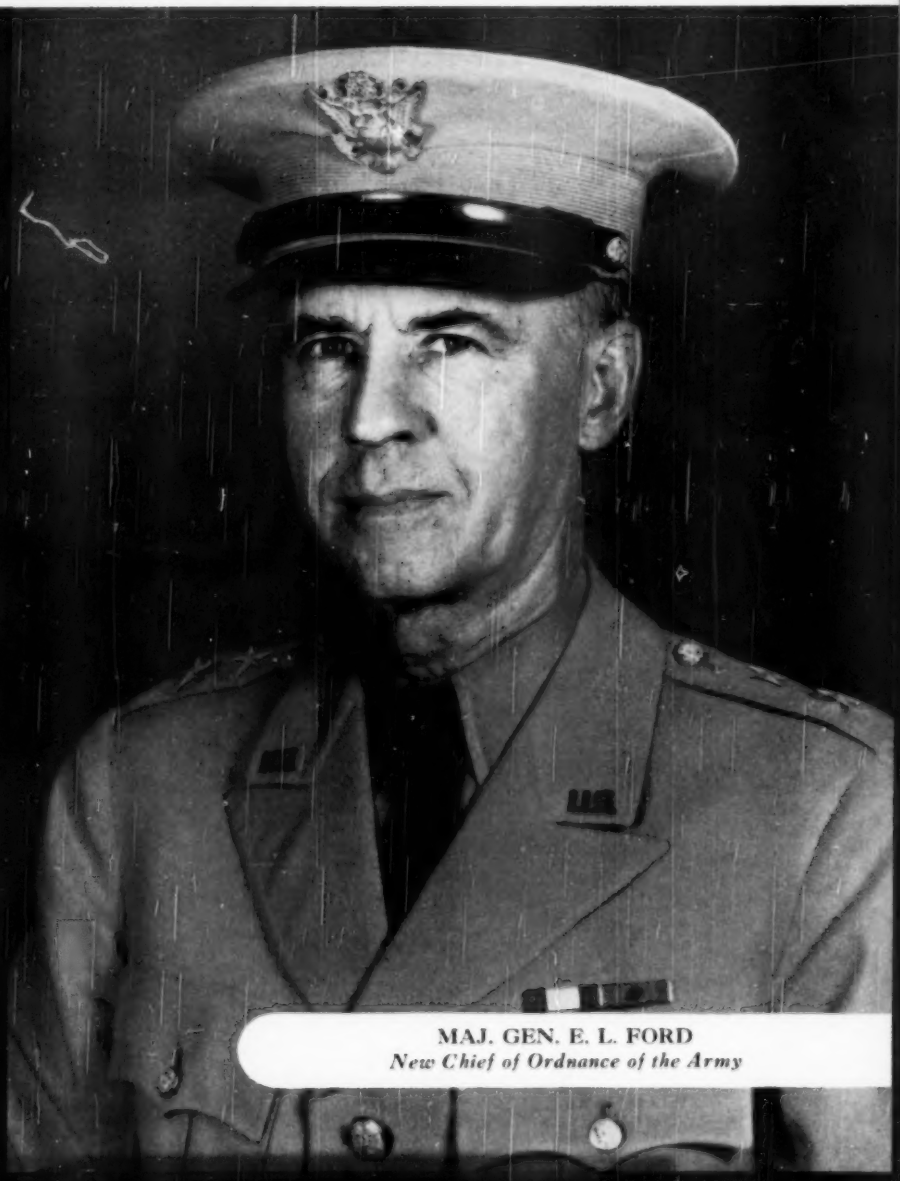
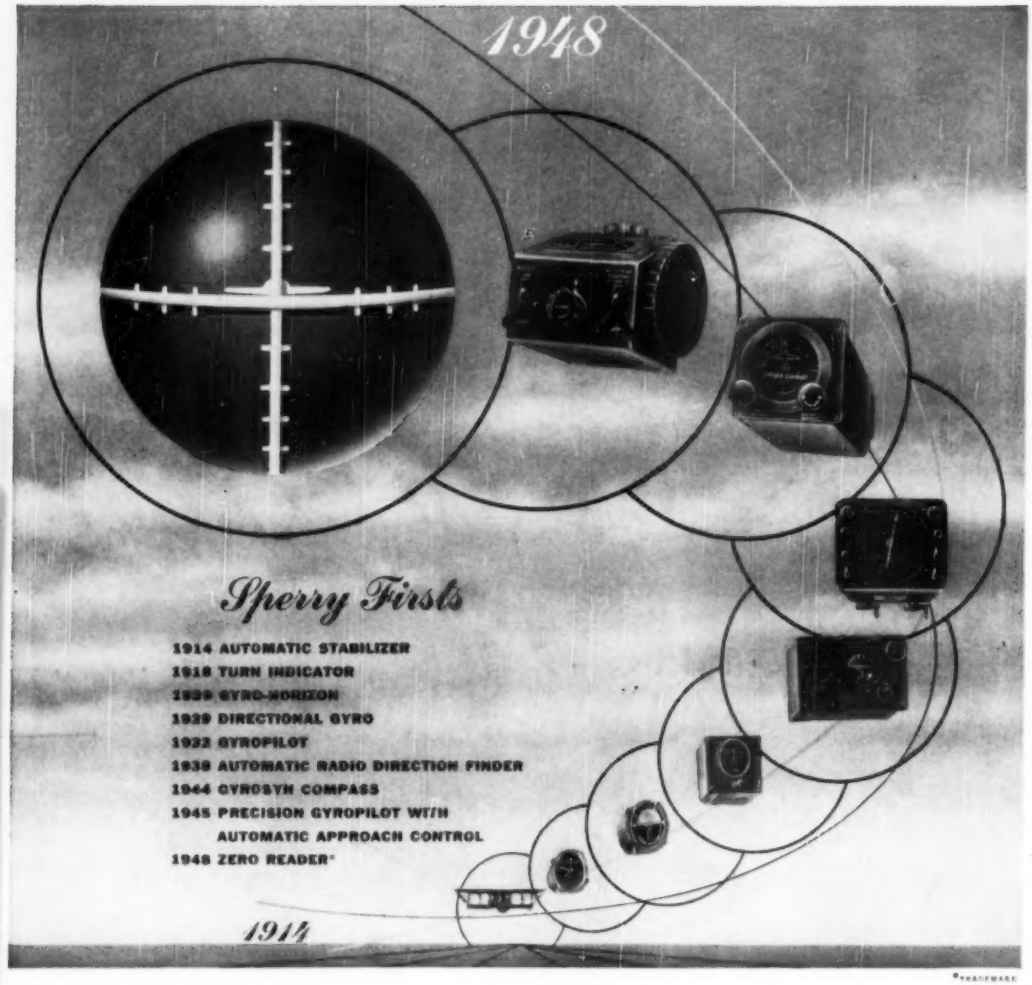
THE JOURNAL
OF THE AMERICAN
ORDNANCE
ASSOCIATION
WASHINGTON, D. C.



MAJ. GEN. E. L. FORD
New Chief of Ordnance of the Army



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ZERO reader*—ANOTHER SPERRY "FIRST"

Man's first airplane instrument for automatic flight was the Automatic Stabilizer introduced by Sperry in 1914. Down through the years, Sperry has developed—through pioneering research and engineering—many added "firsts" in aviation equipment.

Now, Sperry introduces the ZERO READER . . . the only manual system approaching the performance of stabilized automatic flight control . . . another progressive step toward development of all-weather operations.

Developed by Sperry with the cooperation and encouragement of All-Weather Flying Division, USAF and the Air Transport Association, the ZERO READER is an example of Sperry's never-ending search for new ways to improve flying techniques.

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ORDNANCE

Land • Sea • Air

Magazine of Scientific and Industrial Preparedness

THE JOURNAL OF THE AMERICAN ORDNANCE ASSOCIATION

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ABOUT THE AUTHORS

• ORDNANCE is privileged to publish in this issue the address given by Secretary of Defense Louis Johnson at the dinner-meeting of the American Ordnance Association held in his honor in New York on September 21st. This message clearly defines the rôle the industrialist plays in the national-defense program and emphasizes the significant work that the members of the A.O.A. have contributed to the strength and well-being of our armed forces.

• Lloyd Norman, a Washington military correspondent of wide experience in naval affairs, has clearly outlined the importance of the streamlined, schnorkel-equipped submarine to the future planning of our Navy in a splendid article entitled "Warfare under the Seas," appearing on page 165. Mr. Norman points out that the changing aspects of the techniques of war have made corresponding changes in the instruments of naval power thereby complicating the problem of maintaining our dominance of the seas.

• Of current interest to all Americans is the future rôle of air power in the national-defense picture. Maj. Gen. Gordon P. Saville, who has the responsibility of devising the vital plans to defend us from an air attack, explains on page 174 the many intricate operations that will guarantee the best possible protection and security to the Nation from hostile air forces. The intimate relationship between the efficient implementation of this system of defense and the continuing capacity of American industry to produce after war begins must be immediately apparent to every one since no area in the world is too remote from attack in this air age. And industry is the backbone of American security.

• The past war has seen the greatest upsurge in the use and development of the war rocket since the days of Congreve and Hale. But despite the many advances in powder, metals, and manufacturing processes, we have not been able to design a rocket that has the performance or accuracy of artillery. Lieut. Col. Leslie A. Skinner, one of the country's unsung researchers, has devotedly spent years and substance in striving to give America's armed forces a rocket weapon of extreme accuracy that will retain the excellent qualities of lightness, simplicity, and smashing power. His illuminating article on page 184 analyzes and examines the multitude of problems facing the researcher and what possible solution might be evolved in the near future.

—*The Editors*

THE AMERICAN ORDNANCE ASSOCIATION

THE AIMS AND PURPOSES OF THE SOCIETY

The American Ordnance Association, a national society of nearly 30,000 American citizens, was founded in 1919 as the Army Ordnance Association, "pledged to industrial preparedness for war as our Nation's strongest guaranty of peace." The society was incorporated under the laws of the District of Columbia in 1928. During the past 30 years the Association has endeavored to keep alive among all our people an interest in and knowledge of the design, production, and maintenance of military armament. This it has done through periods of public lassitude and times of great national emergency.

The Association is devoted solely to the national defense; it has no commercial interests, no political alliances, and no religious affiliations. It is not operated for profit; its income is expended in furthering its aims. Its elected officers and directors serve without remuneration. Membership, to which American citizens are eligible, is $10.00 for three years or $4.00 for one year. The technical activities of the Association, which are advisory to the armed services, are conducted through national Divisions. Local chapters of the Association are located throughout the United States.

The long-range aims and purposes of the Association are:

1. **Adequate national security.** This is the great goal of peace. It is best obtained through a nonpartisan and persistent national policy which will ensure that the amount of military power—ground, sea, and air—available to this country and its probable friends will never be less than that available to its probable enemies.

2. **Adequate munitions power.** This is one of the two basic foundations of military power. The amount of it in quality and quantity available to the United States and its probable friends for timely and effective use should never be less than that available to its probable enemies.

3. **Adequate military man power.** This is the other main foundation of military power. The amount of it available to the United States and its probable friends should likewise never be less than that required for the timely and effective utilization of the munitions power essential to victory.

4. **An ideal basis for achieving adequate munitions power.** Existing stocks of munitions plus expected production should equal requirements both in quantity and quality at all times. Consequently, the more the United States can depend upon and speed up the mobilization rate of American industry the smaller the stocks we have to maintain, the more up to date our munitions in time of conflict, and the less the cost.

5. **To achieve the[above objectives** the following principles are advocated:

   a. Designs of military armament that are second to none.
   b. Existing stocks of combat and other munitions that are adequate in quantity and quality.
   c. Efficient and dependable industrial mobilization with maximum shortening of the time factors involved, including the political time factor, the administrative time factor, and the industrial time factor.
   d. Current and constant education, training, and development of the military-science-industry team.

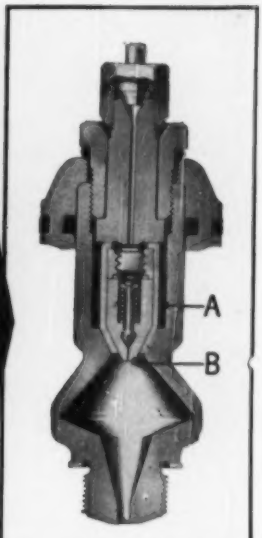
American Ordnance Association

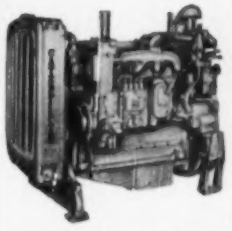
705 Mills Building • Washington 6, D.C.

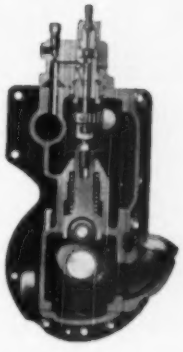
NON-FOULING

fuel injection valve

. . . keeps job moving







"Caterpillar" Diesels' exclusively designed fuel injection valve (A) is a BIG factor in preventing work interruptions. Its single orifice (B) enables the burning of low-grade (low-cost) fuel *without fouling, without clogging.* It sprays the fuel into the specially designed pre-combustion chamber where it is conditioned for clean, complete burning in the cylinder.

So efficient are these *interchangeable* injection valves (one for each cylinder) that countless "Cat" Diesels have operated for thousands of hours without needing replacements. And when such replacements become necessary, the valve is easily changed.

Teamed up with each fuel injection valve is an equally efficient "Caterpillar" designed and built fuel pump. It supplies fuel at the right pressure and with the same dependability that characterizes the functions of all other vital moving parts and enables these power units to pile up hour-meter records that repeatedly excite the wonder of users throughout the world. Being precision-built, "Caterpillar" fuel pumps (like the fuel injection valves) are readily interchangeable.

Let your "Caterpillar" dealer show you what these engines can do for *you*. He's as close as your phone—call him today!

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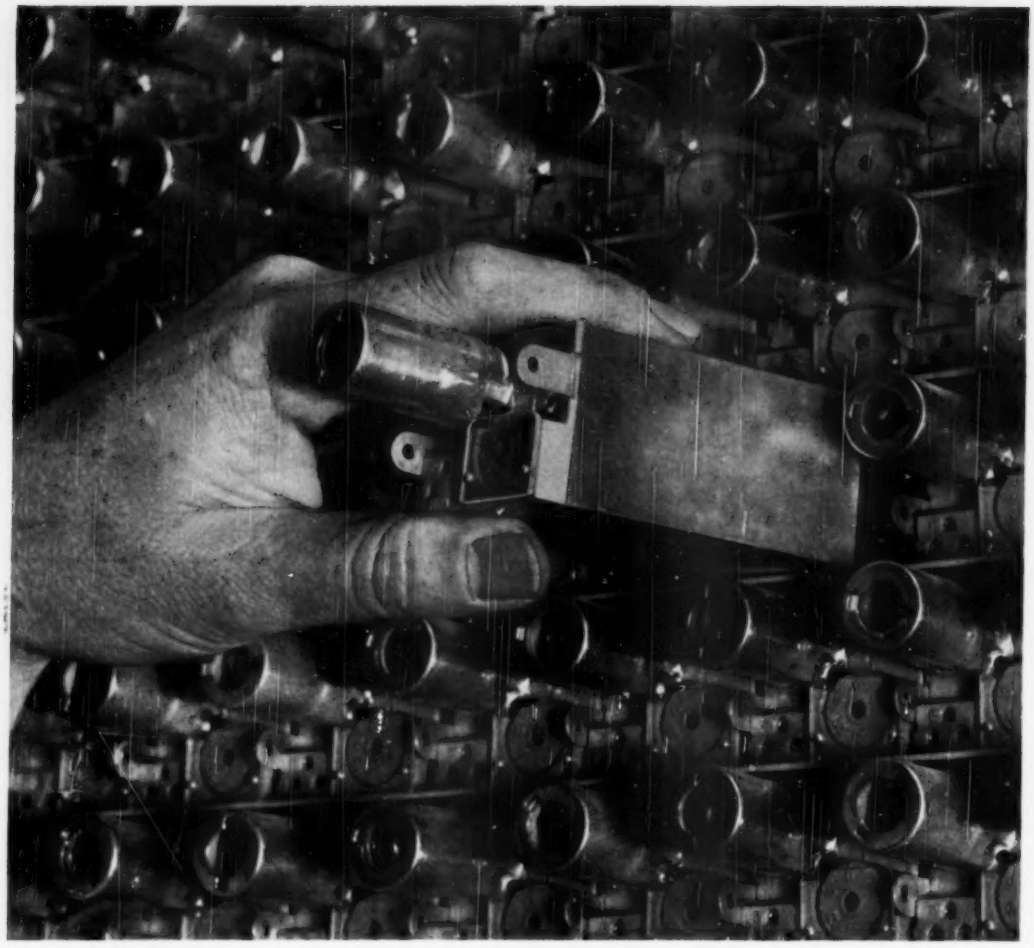

ANOTHER SCORE IN THE

battle of the inches

It takes many costly buildings to house your telephone system. Every inch saved helps keep down the cost of telephone service. So at Bell Telephone Laboratories engineers work constantly to squeeze the *size* out of telephone equipment.

In the picture a new voice frequency amplifier is being slipped into position. Featuring a Western Electric miniature vacuum tube, tiny permalloy transformers, and special assembly techniques, it is scarcely larger than a single vacuum tube used to be. Yet it is able to boost a voice by 35 decibels. Mounted in a bay only two feet wide and 11½ feet high, 600 of the new amplifiers do work which once required a *room* full of equipment.

This kind of size reduction throughout the System means that more parts can be housed in a given space. Telephone buildings and other installations keep on giving more service for their size — and keep down costs.

The new amplifiers, which will soon be used by the thousands throughout the Bell System to keep telephone voices up to strength, are but one example of this important phase of Laboratories' work.

BELL TELEPHONE LABORATORIES EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

Here's why

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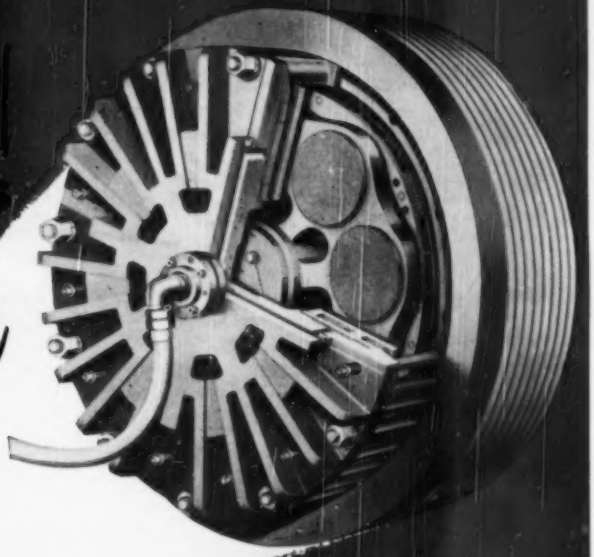
run longer



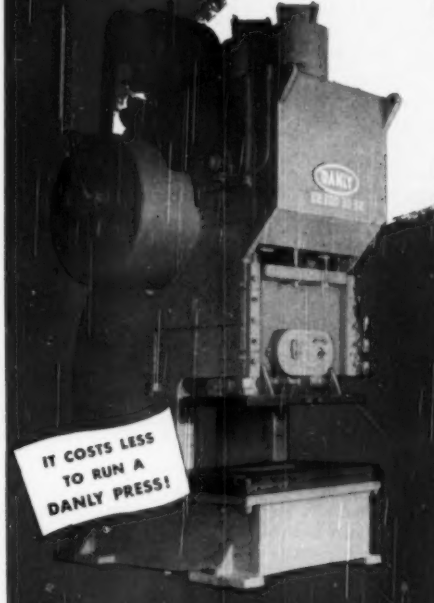
THE NEW COOL-RUNNING DANLY CLUTCH

OUTWEARS CONVENTIONAL CLUTCHES 7 TO 11

and greatly reduces the largest single item of press operating costs, clutch maintenance. The cool-running Danly Clutch overcomes heat... major cause of clutch wear... by reducing clutch "pick up" load 50%. High velocity air circulation of all internal parts produces a still further reduction in operating temperature so that a Danly Clutch in continuous operation runs only 35° above room temperature. Actual tests under normal operating conditions resulted in only .005" of friction surface wear for 100,000 engagements in a Danly clutch against .043" of wear in a conventional type clutch!

And complete renewal of friction surfaces takes less than 30 minutes! Only quick replacement of special friction discs in an easily accessible spider is required. No riveting, fitting or extensive disassembly is necessary.

Other outstanding features include positive pressure lubrication throughout, completely stress relieved frame weldments, and sensitive control reaction. All of these outstanding Danly Press advantages are certain to reduce overall operating costs, through labor savings and longer die life.



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DANLY

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It's fully available for the first time

How you can get it!

ARNOLD can supply REMALLOY in the form of BARS and CASTINGS or SINTERED TO SPECIAL SHAPES

How you can use it!

REMALLOY generally may be used instead of 36-41% Cobalt Permanent Magnet Steel—replacing it without design changes, and at a cost saving.

The first issue of the "Magneteer" contains complete technical information on Remalloy—*write for your copy.*

In addition to our customary production of all types of ALNICO and other permanent magnet materials, we now produce REMALLOY. The various forms in which it is available—bars, castings or sintered shapes—are all produced under the Arnold methods of 100% quality-control; and can be supplied to you either in rough or semi-finished condition, or as completely finished units ready for assembly. ● Let us help you secure the cost-saving advantages of REMALLOY in your designs. Call or write for further data, or for engineering assistance.

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Spicer's 45 years of experience in automotive power transmission engineering pays off in many ways. The SKY-HOOK is a typical example. It is a specially designed aerial vehicle for hauling heavy logs out of rough terrain where there are no roads or usual means of getting out timber. A motor-actuated drum at each end winds up the cable and pulls the vehicle in either direction along the trolley wires. When a change of location is desired, the SKY-HOOK is put on rubber-tired wheels and transported like a trailer. Three sets of Spicer Universal Joints, and one Spicer Brown-Lipe Auxiliary Transmission with top-mounted power take-off, help the SKY-HOOK snake 'em out with speed and economy!

SPICER ENGINEERING is available for the development and application of sound power transmission principles to all automotive needs.

The Spicer-Equipped SKY-HOOK is made by the Pointer-Williamette Company of Portland, Ore., manufacturers of trailers and special rigs.

SPICER ENGINEERING produces Transmissions, Passenger Car Axles, Clutches, Parish Frames, Torque Converters, Stampings, Forgings, Universal Joints, Propeller Shafts, Spicer "Brown-Lipe" Gear Boxes, Railway Generator Drives.

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This exclusive arrangement for Brown & Sharpe Grinding Machines easily detects displacements of .0001" in swivel table movement. Deflections are direct reading . . . no interpolation or transposition of figures needed.

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- Set-Up Time Sharply Reduced
- Easier Operation, Faster Production
- Continuous, Visual Check.

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New Developments

WORLD'S LARGEST BLIMP

In line with its assigned rôle of antisubmarine responsibilities, the Navy announced that construction of a new blimp, designed specifically to carry the latest equipment to combat schnorkel submarines, has been started by the Goodyear Aircraft Company at Akron, Ohio. The new blimp, with an over-all length of 324 feet, will be the largest nonrigid airship ever built.

The big blimp will be able to refuel in flight by dropping a fuel line to a surface ship. It will also be equipped to take ballast by scooping water from the ocean. Two 7-cylinder Wright engines are to be mounted within the control car, enabling repairs to be made while in flight. The two controllable-pitch propellers will be mounted on outriggers from each side of the car.

The gas bag, with a capacity of 875,000 cubic feet, will be inflated with noninflammable helium. The new airship will have a speed of approximately 75 knots, a maximum gross weight of about 55,000 pounds, and will carry a useful load of more than 4½ tons.

ANTISUBMARINE TRAINING

In conjunction with its program of antisubmarine training, the Navy is planning to make its pilots equally proficient flying either blimps or conventional heavier-than-air craft. The new program was revealed in a Navy directive which stated that pilots of Navy lighter-than-air blimps are being qualified to fly conventional aircraft and, at the same time, standard aircraft pilots are being qualified to command lighter-than-air craft. Lighter-than-air officers in ranks of commander and below are eligible to apply for heavier-than-air flight training, and naval aviators in ranks of lieutenant and below can request nonrigid aircraft training.

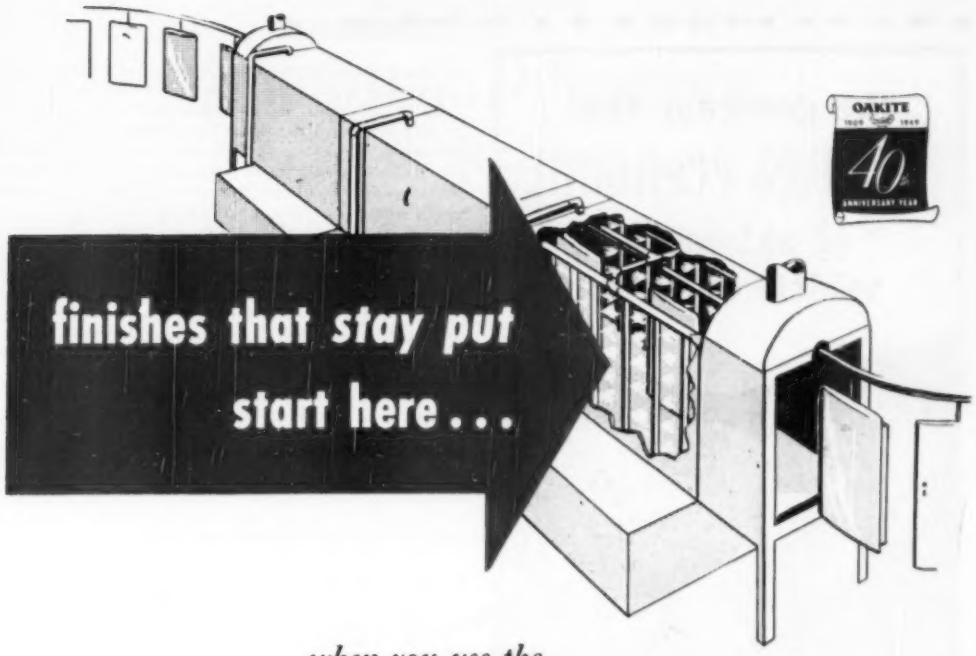
LOGISTICAL UNITS ORGANIZED

Organization of a limited number of logistical headquarters units designed to meet mobilization needs is being planned by the Department of the Army. Headquarters of this type will coordinate the furnishing of supplies, transportation, and other services required in combat areas. Most of the units are to be formed in the Organized Reserve Corps and will be composed of both Reserve officers and enlisted personnel. Units will be allocated to the six Army areas and will undergo active training programs.

The new plans will bring into being for the first time organized headquarters set up for the purpose of coördinating Army service operations. Combat arms have long worked together as a team, with the headquarters of divisions, corps, and armies coördinating their activities. The headquarters units now being planned, the Army stated, will control the many unified service activities needed in combat and help to provide more efficient support to the combat soldier.

NEW F-84 THUNDERJET

The U. S. Air Force's newest version of the Republic F-84 Thunderjet fighter, to be designated the F-84E, will feature increased engine power, 180 maintenance-access doors in the plane's fuselage, wings, and tail assembly, increased structural strength, longer fuselage, aërodynamic fins on the wing-tip tanks,



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to clean and condition ferrous metals before painting, japaning, lacquering

Benefits You Get with the Oakite CrysCoat Process

- fast, thorough cleaning
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- solubility of material
- solution stability against change
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METAL FINISHERS!

Possibly you already know about the Oakite CrysCoat Process. But did you know Oakite also makes materials for precleaning by tank and machine; alkaline cleaning by tank and machine; pickling; barrel cleaning; electrocleaning; paint-stripping; steam-gun cleaning; burnishing and anti-rusting. For free facts about any of these cleaners, drop us a card.

That 3-stage automatic washing machine you're looking at is applying the Oakite CrysCoat Process—a specially formulated acid surface cleaner and conditioner that provides proper adhesion for durable, sales-appealing finishes. And does it at amazingly low cost per square foot of coverage.

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The widely-used Oakite CrysCoat Process conditions metals *three* ways in *one* operation. It thoroughly, uniformly removes light oils, grease, spinning compounds and shop dirt. At the same time, the Oakite CrysCoat Process develops on steel and iron an inert, microscopically thin phosphate film that forms a highly receptive base for paint and other organic finishes; inhibits rust before finishing; localizes corrosion if finish is broken. The Oakite CrysCoat Process is designed for application in a three (or more) stage pressure-spray washing machine. Conclusive tests show that no continuous accumulation of scale and sludge build-up on equipment. A conveniently located Oakite Technical Service Representative will be glad to test-run the Oakite CrysCoat Process on your iron and steel products. Demonstrate its versatility as a conditioner for aluminum, zinc, iron, terne plate and copper alloy fabrications. Complete details contained in . . .

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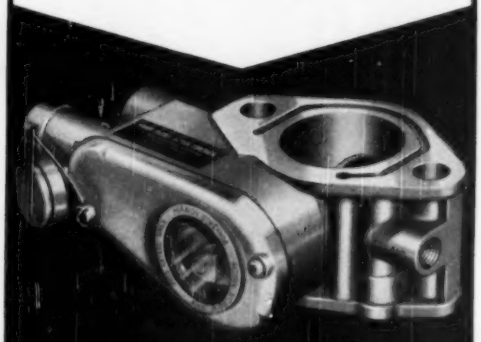
Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

the governor that

assures economy

of automotive vehicle operation



The Handy Vari-Speed Governor used on many well-managed truck fleets over a period of years has proved its outstanding value in preventing costly operating practices.

A poll of 180 such fleets shows actual savings as follows:

General maintenance	26%
Engine repair	32%
Tire maintenance	22.6%
Insurance	16%
Lubrication	26%
Fuel	13.5%
Brake maintenance	29.2%
Accidents	37%

Other King-Seeley automotive instruments with long successful service records include:

- Telegages—Fuel level, oil pressure and water temperature
- Ammeters • Speedometers

Specify KS control instruments for greatest effectiveness and economy of automotive operation.

KING-SEELEY CORPORATION

ANN ARBOR MICHIGAN

PLANTS IN ANN ARBOR • GRAND RAPIDS • YPSILANTI

New Developments

and also a new cabin pressurization and air-conditioning system.

The power of the F-84E is supplied by an Allison J-35-17 turbo-jet engine rated at 5,000 pounds' thrust, an increase of 25 per cent over previous models. The combat radius of the new Thunderjet will be more than 850 miles, compared with the 600-mile radius of present models. The service ceiling has been increased to over 45,000 feet. Present models have an announced service ceiling of more than 40,000 feet.

CERAMICS FOR HEAT

Results of recent tests at the National Bureau of Standards have shown that several ceramic bodies previously developed by the Bureau have marked superiority, in both strength and creep characteristics at 1,800 degrees Fahrenheit and above, over the best available high-temperature metal alloys. Laboratory data indicate that these ceramic bodies, especially designed for use in jet engines and gas turbines, possess special properties required at the elevated operating temperatures of these power plants.

SPACE EXPLORER

A new device to help discover the "kind of things a man on a trip to the moon would need to know" is being developed by scientists at the Armour Research Foundation of the Illinois Institute of Technology in Chicago. A metal sphere containing heat-measuring equipment, a camera to record readings from the equipment, and gyroscopes to stabilize the flight of the sphere will be hurled from a high-speed rocket at an altitude in the neighborhood of seventy miles over the earth.

The work on the upper-air research instrument is being supported by the Air Matériel Command, U. S. Air Force. A radio transmitter on the camera will help in tracking the flight to earth when the sphere drops, and a parachute device is planned to enable scientists to recover the valuable film record made by camera.

GIANT BOMB HOISTS

A $1,199,464 contract for lifts for the Air Force's biggest bombs—22,000 and 50,000 pounds—has been announced by Boeing Airplane Company. Electric motors, actuating a hydraulic system in the 25-ton lift, can hoist the huge bombs 12½ feet, roll them 360 degrees in either direction, shift them 4 inches either side of center and 10 inches fore and aft, and tilt them 6 degrees up or down.

One man, operating six levers, thus can handle the huge bombs with ease. Behind a jeep or truck, and carrying a 25-ton bomb, the lifts can be towed as fast as twenty miles an hour. They are demountable for transport by air.

SHIP STABILIZATION

A new ship-stabili ation system designed to reduce the rolling motion of vessels by eighty per cent was recently readied for extensive sea tests at the Naval Shipyard, Norfolk, Va. Operating on a counterbalance principle, the new stabilizing system consists of two pairs of large tanks mounted on opposite sides of the ship. The bottoms of the tanks, each half filled with ballast water, are connected athwartships by transfer ducts.

Powerful, electronically controlled impellers automatically pump water back and forth at a rapid rate to counterbalance the ship's rolling motion. Actually the motion is corrected just as it commences. The electronic equipment detects the roll at a very early stage, immediately producing a signal to actuate the pumping equipment. The pumping is accomplished with two large variable-pitch propellers in the transfer ducts near the bottoms of the tanks. Naval ordnancemen and engineers point out that accuracy of weapons would be greatly improved by the more stable firing platforms offered by a successful stabilizer. Carrier landing operations would be simplified, and

WHAT'S THE

Important Difference

BETWEEN

Carbon Steels and Alloy Steels?

No SINGLE characteristic denotes the real difference between alloy steels and carbon steels.

Certain of the most useful mechanical properties—strength, hardness, toughness, ductility—can be developed to a high degree, individually *but not collectively* in carbon steels.

Nor can such desirable characteristics as response to mild quenching, high strength and elastic properties in large sections, and good resistance to distortion and cracking in heat treatment of complex shapes be developed in carbon steels.

In nickel alloy steels *all* of these characteristics can be obtained, in greater or lesser degree, *at the same time*. From among the many grades of standard alloy steels containing nickel it is possible to select one which provides the best set of properties for meeting virtually any reasonable requirements.

Yes, in the final analysis, it is the better, more complete *combination* of properties—and, therefore, better performance and long-range economy—available in the nickel alloy steels which constitutes the most significant difference.

We shall be glad to furnish counsel and data to help you select the right nickel alloy steel for your requirements.

EMBLEM OF INCO SERVICE

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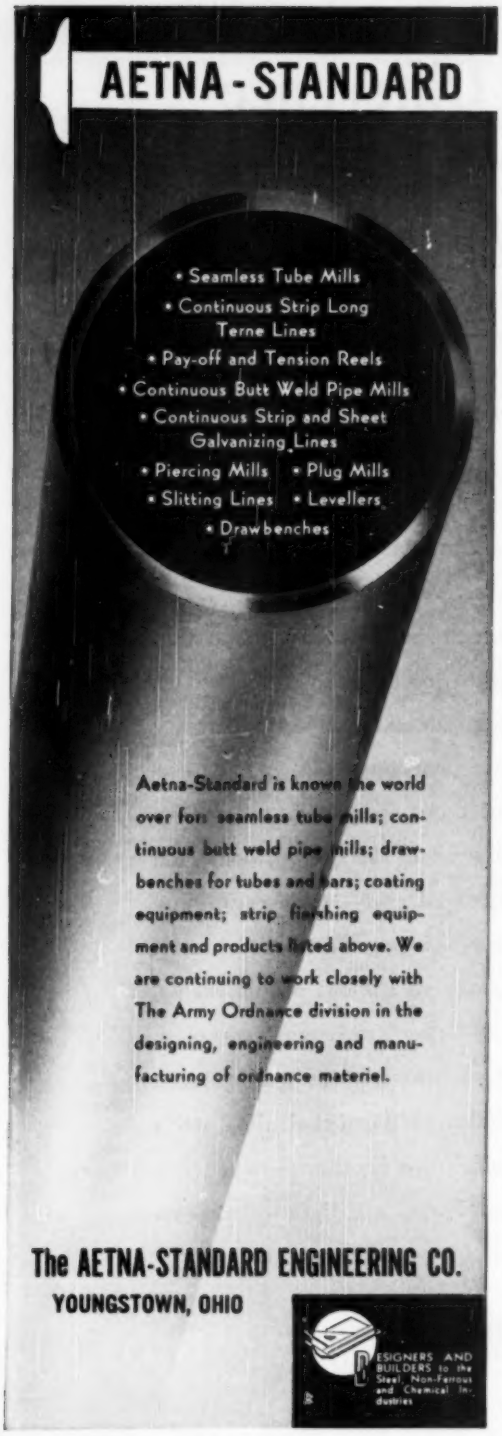
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Aetna-Standard is known the world over for: seamless tube mills; continuous butt weld pipe mills; drawbenches for tubes and bars; coating equipment; strip finishing equipment and products listed above. We are continuing to work closely with The Army Ordnance division in the designing, engineering and manufacturing of ordnance materiel.
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the discharge of cargo and troops in open seaways, with the vessel at anchor, would be expedited.

HEAT-RESISTANT ALLOY

A new metallic compound which will withstand the high temperatures of modern gas turbines and jet and rocket engines has been developed under an Office of Naval Research contract with the American Metals Corporation. The compounding process, using zirconium and boron, provides an alloy which, in recent tests, survived the highest temperature blasts of any metallic materials extensively tested to date.

UNDERWATER TELEPHONE

New instruments to increase submarine effectiveness are being developed by the United States Navy at its sound laboratory at New London, Conn. Among these devices is a telephone for voice communication through water which should prove of especial value between a submarine in distress and a searching party.

B-50 ON TRACKS

Taxi tests have been successfully completed on the first B-50 medium bomber to be equipped with track-tread landing gear. The 164,000-pound B-50, improved version of the wartime B-29 Superfortress, carried the new experimental landing gear to investigate possibilities of utilizing unimproved, unpaved runways for operation of heavy aircraft, such as medium bombers, tankers, and transports. Other aircraft already have been equipped with the tractor-type landing gear.

ELECTRONIC CALCULATOR

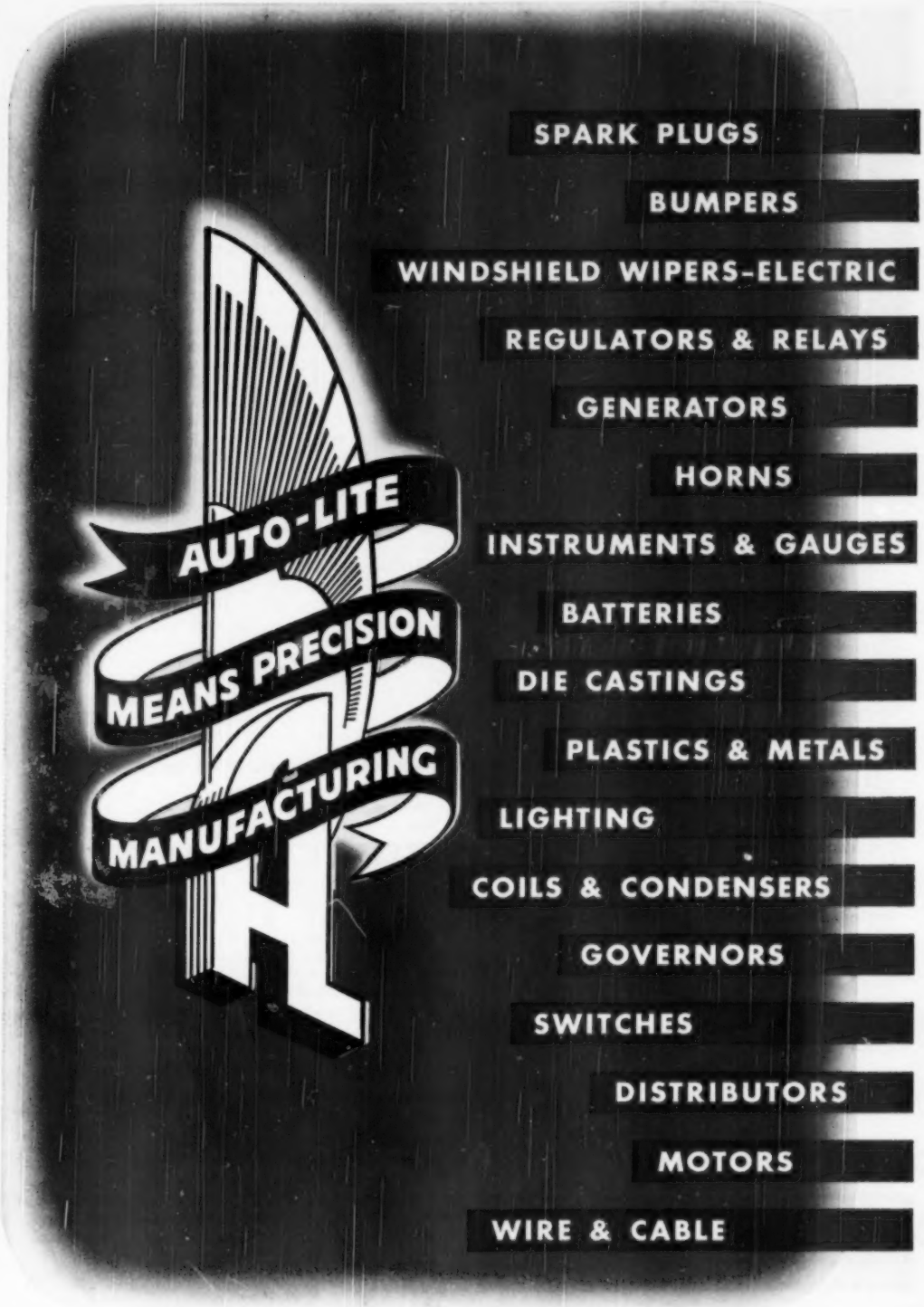
The Eckert-Mauchly Corporation recently announced what is said to be the world's second all-electronic automatic computing machine, with speed and accuracy 12,000 times faster than a human being. The new calculator is five feet high, four feet long, and one foot wide. With its accessories, however, it requires a much larger space. It has been named BINAC, because it uses a binary system. The only other all-electronic computer is the ENIAC.

JOINT WINTER EXERCISE

Canadian and United States troops will conduct a joint winter training exercise in the Yukon and Alaska next January and February. The exercise, designated "Cross-Index" for planning and operational purposes, will be local in nature and on a comparatively small scale. It will be a continuation of the combined training program carried out by both countries during the past few years. Present plans call for the United States Army and Air Force to join the Canadian Army and the Royal Canadian Air Force in simulated combat, culminating in movements against a theoretical enemy.

The Canadian Army and the United States Army will each provide a one-battalion combat team including infantry—some of which will be employed in a parachute rôle—artillery, engineers, signals, and other supporting arms and services. The Royal Canadian Air Force and the United States Air Force will combine to provide fighter cover, ground attack forces and bomber, reconnaissance and transport aircraft. In addition to existing communications, mobile RCAF and USAF signal equipment will be used. Mobile Air Force radar and control centers will also be employed. The exercise will take place in the Whitehorse area.

The objectives of the exercise are to develop procedures, doctrines, and techniques for the employment of combined Canadian-United States ground and air forces operating in the far north. *(Continued on p. 158)*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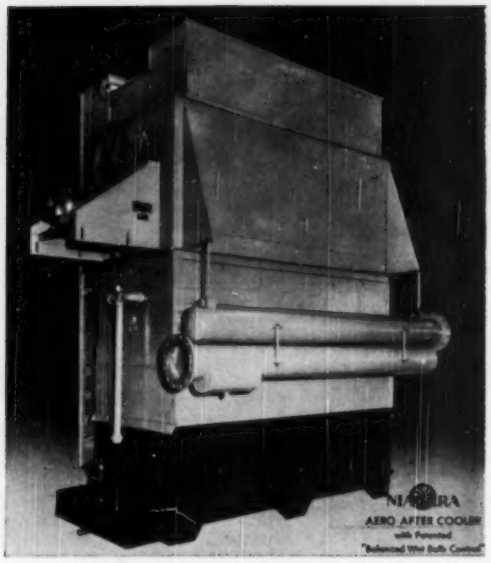

How to PREVENT CONDENSATION in COMPRESSED AIR LINES

● Users of pneumatic tools and machinery spend thousands of dollars on repairs and suffer much interruption to production from the condensation of water in their air lines. In compressed gas systems and in processes where compressed air is blown directly on parts and materials, there is additional damage.

You can prevent these losses by installing a Niagara Aero After Cooler. It cools the compressed air or gas by evaporative cooling and removes the water before the air enters the receiver. This method brings the air to within a few degrees of the wet bulb temperature, making certain that your compressed air will always be colder than the atmosphere surrounding the lines in your plant, so that no further condensation can take place.

Savings in cooling water pay for the installation. Experience shows that the patented Niagara evaporative cooling method consumes less than 5% of the water required for cooling by conventional means. You save the cost of the water, the cost of pumping it, the cost of disposing of it. These extra savings soon pay for the Niagara Aero After Cooler.

Write for Bulletin No. 98

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New Developments

TURBO-PROP ENGINE TESTED

The U. S. Air Force's newest turbo-prop engine—a propeller-driving, gas-turbine, aircraft engine—the Turbodyne XT-37-1, has been installed in a Northrop YB-35 Flying Wing at Hawthorne, Calif., for flight-evaluation tests. The Turbodyne engine utilizes the shaft power of a gas turbine to drive a propeller. Because of the inherent high speed of the gas turbine, a reduction gearing is necessary to drive the propeller at its most efficient rotating speed.

COLD-RESISTANT STEEL

A new alloy steel capable of fulfilling extraordinary engineering requirements of subzero service at operating temperatures as low as minus 423 degrees Fahrenheit, has been developed by Lebanon Steel Foundry. An austenitic cast ferrous alloy containing 19.50 per cent chromium and 9 per cent nickel, among other alloying constituents, it has shown no structural changes down to minus 423 degrees in hundreds of testing laboratory impact tests from production lots of castings.

The alloy already has been used effectively in the production of castings for pressure equipment in storage facilities for liquid oxygen used as a propellant for rocket engines. Such storage is maintained under high pressures at temperatures of approximately 298 degrees below zero.

BRITISH FLYING BOATS

England is increasing production of giant flying boats for overseas civilian transportation, and the first ship of the new "Princess" fleet will be ready for flight early in 1951. The new double-deck flying boats, which British Overseas Airways Corporation will operate across the Atlantic to South America, will weigh 140 tons. Ten Bristol Proteus turbo-prop engines will provide each Princess with power. Eight of them will be arranged in pairs, and two separate units will be placed in an extreme outer wing position. With a total of 35,000 horsepower, the ships will be able to cruise at 380 miles an hour. They are designed for a still-air range of 5,500 miles.

UPPER ATMOSPHERE RESEARCH

The U. S. Air Force is scheduled to fire sixty Navy-developed "Aerobee" rockets at Holloman Air Force Base, Alamogordo, N. Mex., to fulfill a program investigating the composition of the atmosphere at altitudes up to seventy-five miles above the earth. The new program will supplement existing Army, Navy, and Air Force upper-atmosphere studies utilizing German V-2 rockets launched by the Army at its White Sands Proving Ground, N. Mex.

Electronic recording instruments will be placed in special compartments of the 20-foot-long Aerobees by thirty different U. S. colleges or research institutions during the program. Each research organization will be responsible for instrumenting one or more rockets at some time during the 2-year schedule of launchings. The instrumentation and the evaluation of collected data will be carried out by each individual organization under contractual agreements with the Air Force.

ELECTRONIC STATISTICAL MACHINE

The International Business Machines Corporation has come up with a new machine that promises to be of great aid to the armed services in controlling and handling the almost overwhelming amount of records needed to keep track of vast amounts of material. Called the electronic statistical machine, it combines in one unit the functions of sorting, counting, accumulating, balancing, editing, and printing of information recorded on cards. This machine is capable of providing comprehensive statistical analyses of many types in a minimum of time.

These Timken-Detroit Axle-equipped truck-cranes work as a team to place 20-ton, 200-ft. timber trusses.

Peace insurance begins on jobs like this!

The bigger they are—the transport jobs so vital today to America's commerce and industry—the bigger the trucks it takes to get them done. Biggest of all, to you, is the *power for peace* this trend exerts:

All the world knows that each super-truck is a potential military machine; that every big civilian transport development shows the way to bigger and finer military equipment; that every man-hour invested in such development strengthens America's defense capabilities.

Wherever engine-propelled wheels turn, on the road or off, Timken-Detroit Axles continue unceasingly to prove themselves "The Accepted Standard" for heavy-duty vehicles of every kind. For more than 40 years, Timken-Detroit research, engineering and production have played a major part in the progress of heavy transport—a *continuing program* of peace insurance!

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Nineteenth Army Ordnance Chief

Maj. Gen. E. L. Ford Assumes Important Office

MAJ. GEN. ELBERT L. FORD assumed the office of Chief of Ordnance of the United States Army on November 1, 1949—the nineteenth officer of the Army to be nominated by the President and approved by the Senate for that high responsibility since the establishment of the Department. He succeeded Maj. Gen. Everett S. Hughes who retired for age October 31, 1949. Thus the scepter of Ordnance direction was passed on in unbroken continuity through one hundred and thirty-four years—a lineage which has played a vital part in the peace and security of our Nation.

General Ford has undertaken his new duties after four years of outstanding achievement by General Hughes. Those four years have been fraught with decisions and activities of transcendent significance. It was General Hughes' difficult assignment to conduct postwar operations during a period when the acceleration of war and the impetus of battle had ceased. He led the Ordnance Department with phenomenal success and attuned it to the new conditions which follow every great conflict. His relations with American industry, and especially with the American Ordnance Association through its Technical Divisions and Committees, will have a lasting effect upon industrial preparedness for many years to come.

Career Ordnance Officer

General Ford is a career Ordnance officer of long service. Appointed to the United States Military Academy from his native State of Connecticut, he was graduated April 20, 1917, and commissioned a second lieutenant in the Coast Artillery Corps. He served during the First World War in Puerto Rico and in France. Transferred to the Ordnance Department on July 1, 1920, he filled many important assignments throughout the following two decades. He was graduated from the Ordnance School, the Command and General Staff School, and the Army Industrial College.

With the advent of World War II he performed one of his most notable contributions to Ordnance success as works manager of the Springfield Armory, Springfield, Mass., from 1940 to 1942. Those were the trying times at Springfield when the semi-automatic rifle M1 (Garand) was brought to quantity production. That achievement in itself merited for General Ford well-won acclaim from his military superiors.

In September 1942 he was appointed Chief Ordnance Officer, Allied Force Headquarters, European Theater of Operations. In November of that year he was sent to North Africa and two months later was named Chief of Staff, Headquarters, North African Theater of Operations. For his exceptionally noteworthy services in the Second World War General Ford was awarded the Distinguished Service Medal. He was also awarded the Legion of Merit with oak leaf cluster.

Ordnance Chief in Europe

In July 1946 General Ford again returned to Europe, this time to become Chief of Ordnance of the United States Forces in the European Theater of Operations with headquarters at Frankfurt, Germany. Here he organized with consummate skill the vast reclamation activities required by conditions in that area. It was the good fortune of this writer to observe at first hand the magnitude of these operations throughout the American Zone of Occupation. The efficiency, economy, and good judgment with which these difficult tasks were performed were apparent on every side.

In June 1948 General Ford became commanding officer of the Aberdeen Proving Ground, where he continued the effective postwar work of his predecessor, Maj. Gen. A. B. Quinton, Jr. Here, too, the rôle of the proving ground in the newer concepts of Ordnance progress as indicated by the research and development program of the past four years received his sympathetic and capable attention. The broad Army Ordnance research program as directed by Maj. Gen. Henry B. Sayler was energetically prosecuted with fitting success at Aberdeen.

Thus General Ford brings to the important office he has assumed a breadth of experience in the military and industrial fields which augurs well for his tenure as Chief of Ordnance. He has the qualifications which have marked his predecessors as outstanding leaders whose handwork has made American ordnance the acknowledged American institution it is today.

Science-Industry Cooperation

As in the past, ordnance success will require the coöperation of American science and industry in accelerated degree. And here the American Ordnance Association, speaking for that wide segment of science and industry which it represents, can extend to General Ford, with prompt and unfailing assurance, every possible coöperation and support at every turn of the way during the years ahead.

The local Posts of the Association from coast to coast will continue their efficient function of disseminating ordnance information to American industry and to the American people generally and thus help to make known the broad educational policies a proper understanding of which is so essential to ordnance progress.

The Technical Divisions and Committees of the Association, so generously sponsored by General Hughes and now actively at work on production-engineering problems in every phase of ordnance technology, will continue to bring to the ordnance organizations of the three services the skills and experience of countless industrial leaders whose contributions in the Second World War made ordnance production techniques one of the marvels of that phenomenal period.

These civilian strongholds, in close coöperation with the Ordnance districts, the arsenals, and the depots, can continue to support in closest coöperation the intricate machine which the new Chief of Ordnance now directs.

General Ford can face his weighty obligations with confidence, knowing that he has the support and coöperation of countless friends and organizations. In the vanguard of these stands the American Ordnance Association of which he became a faithful member many years ago.—L.A.C.

Partners in Preparedness

Three Decades of A.O.A.-Military Cooperation

Hon. Louis Johnson

Secretary of Defense of the United States

Secretary Johnson delivered this address at a dinner-meeting held in his honor by the American Ordnance Association at the Hotel Astor, New York City, on September 21, 1949. C. Stewart Comeaux, president of the New York Post of the Association, presided. James L. Walsh, national A.O.A. president, was toastmaster and introduced Secretary Johnson. Colonel Walsh's introductory remarks will be found on page 186, and an account of the meeting, with a list of the guests of honor, is published on page 194. See pictures on pp. 188-189.

AT this great banquet I confess I am thrilled with what your president has said and by your reception, and I feel very humble at the quoting of the impromptu words of Jim Forrestal in this hall six months ago.

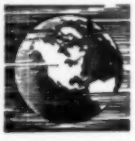
I am glad to be here tonight, gentlemen of the Ordnance Association. It is good always to be in the house of your friends. When I became the Assistant Secretary of War in 1937 I found in the then Army Ordnance Association a most devoted and invaluable ally in the vital cause of national defense. You members of the Ordnance Association already had absorbed the important lessons of World War I.

As far back as 1919 you had determined that in case of another conflict America would have to be its own arsenal—that the French 75's and the British saddles and the Spanish mules that served us so well in 1917 and 1918 might not again be readily available. You realized, too, that our country did not want a powerful munitions industry established in peacetime. You recognized that America preferred to put its trust in the genius and the adaptability of American industry and its ability to convert its production from plowshares to swords in an emergency. You understood the meaning of industrial mobilization. You and I recognized how pitifully inadequate were our military preparations at that time.

May I put in the record that your help in my efforts at that time to strengthen national defense was a source of great strength. You, then as now, were men of great integrity. You didn't just render lip service to national defense. You worked with me for industrial preparedness. We may not have accomplished everything we believed should have been done, but we did make an appreciable start. We did get appropriations for educational orders and stock piles of strategic materials. We did allocate industrial plants for conversion to the production of specific items in time of war. We did a great deal to awaken America to the dangers of war.

Assistance of the A.O.A.

In those uphill endeavors the facilities of the Army Ordnance Association were always available. I remember that on a number of occasions here in New York, in San Francisco and Los Angeles, in Rock Island, in Pittsburgh, and in other places, you assembled the industrial leaders of America. You served well the cause of national defense in many ways as did the renowned Chiefs of Ordnance who helped found and guide your organization—Crozier, Williams, and the rest. I shall always remember with gratitude, too, the Ordnance officers on my staff on whose loyalty and experience I learned to lean so heavily. There were Wesson, Charles Harris, "Jimmie" Burns, and many others, both in and out of Washington, and there were the Ordnance district chiefs who did so much to keep industrial mobilization in the forefront.



When I returned to Washington about six months ago it was natural for me to dip into that known pool of brains and experience in the Ordnance Department to select an outstanding man to help me. I brought back from retirement an Ordnance officer well known to all of you, who, to my mind, is one of the best American Army men of all times. His remarkable ability attracted the attention of the late President Roosevelt. He was given the crucial assignment of administering the program of Lend-Lease. In this historic mission he served with rare distinction.

Of his pioneering contribution in that hour of peril, one national-defense official said: "He brought great inspiration and impetus to the program in a manner for which he forever deserves well of his country." Robert E. Sherwood, in his famous biography of Roosevelt and Hopkins, praises him as a "doer who worked fast." I refer to one I deem my elder statesman, and to whom I will constantly look for advice, particularly on foreign military affairs and generally on anything connected with my job—Maj. Gen. James H. Burns, Retired.

And now, as before, I again find the American Ordnance Association in the vanguard of the patriotic organizations fighting for national defense.

A little more than a month ago I had the occasion to commend you on the high quality of the technical reports you submitted for expediting production in an emergency. I note you have changed your name. You are now the "American Ordnance Association." I applaud the change because it is in keeping with the times, with the trend toward over-all unification, which I promise you we are going to achieve.

Unification Not New

Unification in ordnance matters, however, is not new. I found that out back in 1937, and I commented on that fact in a speech before the Ordnance Association at Rock Island Arsenal on May 25, 1938. In that same speech I also said this about American industry:

"We are greatly encouraged to believe that American industry is capable of carrying a major war load and, with proper education, will accomplish its mission with a minimum of dislocation to its own plants and with maximum

usefulness not only to the efforts of the men at the front but with a full regard for the needs of a solid civilian front behind the lines."

These sentiments of mine about American industry, uttered three and a half years before Pearl Harbor, proved to be prophetic. The quality of American ordnance produced by American industry, delivered where and when needed, in the quantity desired, by American means of transportation, did indeed save hundreds of thousands of lives in World War II. And respect throughout the world for American ordnance and the management and the skills and know-how behind the production of these American munitions stands out today as the greatest deterrent to any would-be aggressor to start a war which might again lead to the sacrifice of so many precious American lives.

Life Is Sacred

In our democracy, our supreme tenet is that American life is sacred, and those of us charged with national defense recognize as our prime duty and responsibility the protection of lives against war. With us the right to life is an inalienable right proclaimed in our Declaration of Independence, traditionally embedded over the centuries in our heritage of the common law and established under our Constitution.

However, to countries governed by dictators the life of an individual is not a matter of great concern. Another life is just another cog in the aggressive machine, always replaceable by another spare part readily available. Nor does the dictator have an electorate to which he must account for the loss of any of these parts.

War to the dictator, therefore, is part of his daily gamble. He will stop at nothing to win. He drugs his rivals' will to resist by vicious propaganda. He is a gambler who thrives on tips and hunches, but he does understand force. He respects the meaning of odds. The one way of handling a would-be aggressor is to convince him conclusively that his odds against winning are so great that he will reform or at least never get started.

That is why we of America have a preparedness program. We must let the aggressor—and there is only one possible one in the world—see in advance of any hostilities what he will be up against. That is why we need the strength of American industry marshaled in support of American forces in being. In that powerful combination we will find the road to peace—*peace through strength*—and it is peace through strength that is the goal of American policy today.

Our responsibilities to ourselves and to the civilized world presuppose, first, military strength, and, secondly and of equal importance, the economic health capable of supporting that military strength. One without the other would be unavailing. The formula is military strength plus economic health and strength. They presuppose a productive economy susceptible of rapid and orderly conversion to the quantity manufacture of weapons and other implements of war of the highest quality.

Because of the amazing adaptability of American youth, we know that we can train military forces for combat more rapidly than we can produce the intricate weapons of modern warfare with which they must be armed. This fact makes it all the more imperative that men such as are gathered here tonight and we of the Defense Establishment take every conceivable action to assure the mobilization of industry in the shortest possible time after the first flash of an emergency.

You of this Association and I have always subscribed to that philosophy of preparedness. That is what we worked for in the days to which Colonel Walsh referred in introducing me. We adopted a plan of industrial mobilization long before Pearl Harbor, but because that plan was attacked in some quarters it was never fully put into effect.

Today, however, we are ahead in at least one respect. The close bearing of industrial preparedness upon the national security is no longer questioned by any segment of our people. Rest assured, moreover, that the Department of Defense is exerting every effort to perfect these industrial-mobilization plans and measures in the light of the experience of World War II.

Must Know Requirements

Our foremost task in the preparation of these industrial-mobilization plans, as you so well know, is now, as it has always been, to develop a comprehensive statement of the probable wartime requirements of the Army, the Navy, and the Air Force. Presented simply, our goal is to determine what will be needed, when it will be needed, where these needs can be filled, and how they will be obtained. It is essential that we be able to tell industry what we want it to produce, the quantities that will be needed, and the schedules on which deliveries will be required. Had we been able to do this fully in time for World War II, we could have saved more than a full year of hostilities.

Mobilization Plans

Let us consider for a moment a few of our present industrial-mobilization plans. These plans are not drawn up in ivory towers by isolated theorists. They represent the best-considered thinking of our top defense and top industrial leaders. While industry's participation is voluntary, you and I know how effective it has been, and it is the continuing participation such as you have given us in the past that will make it possible for industry, in turn, to develop its own plans for rapidly converting for wartime production if necessary.

We have initiated a program of preparedness studies. We are seeking to discover possible bottlenecks. In some cases we have procured the actual tools that will be needed. We have held pilot runs for test models and produced small quantities to train the man power. We have already selected some seven hundred items, representing approximately fifty per cent of the dollar value of wartime procurement, for special allocation to industry, and their wartime requirements will be available before the first of next year. This group may seem numerically small when compared with the two and a half million different items to be purchased. They are all items, however, of the highest essential importance in waging war.

We are working on a plan for priorities and allocations that will be the management tools to direct industrial production and distribution and the construction or expansion of facilities. We have lined up the stand-by plants for use in emergency. As you of this Association know, during World War II the Government built 1,595 plants at a cost of more than twelve and a half billion dollars. About two-thirds of

them are currently held in the national-defense reserve.

We are allocating production to private industrial plants so that our suppliers will know in advance what we expect them to produce in an emergency.

We are working on a reserve of 182,000 items of tools and other equipment. In the man-power field we are working closely with the National Security Resources Board on such matters as training workers, using skills to the best advantage, placing production orders in areas where the labor supply is relatively abundant, and assisting industry with respect to man-power priorities.

We have purchased and placed in a national stock pile, thanks largely to Don Carpenter, over nine hundred million dollars' worth of strategic materials, and we hope that pending legislation will enable us to add to its size.

We have also made substantial progress in current procurement policies. We have assigned complete purchasing responsibility to a single department whenever the interest of the Government could in this way best be served. The Army Quartermaster, for example, purchases all food for the services; the Navy, all the hand tools; the Air Force, all the photographic equipment. For the procurement of medical supplies we operate a joint purchasing board. For procurement of aircraft, a plant is assigned to the Air Force or to the Navy, and the service selected takes care not only of its own needs but also those of its sister service.

Single Catalogue System

The project of a single catalogue system, detailing the millions of items used by the Army, Navy, and Air Force—a tough, tedious job—has just been revamped and moved on a pace, and we hope to finish it next year.

We are working on the standardization of equipment, the development of uniform engineering standards—something you and I talked about a lot from 1937 to 1940—and the standardizing of specifications. Standardization in the aëronautic, electrical, and electronics fields has made substantial progress, and ground rules and priority ratings are being developed for a systematic approach to the problem in all commodity fields.

These are some of our industrial-mobilization plans which are designed to give America maximum security without militarizing our Nation or bankrupting our economy.

In munitions potential the United States holds the real balance of power in the world. Because we can expect to be outmanned numerically, we in America must make up the difference in man power by the superiority of our weapons. With the help of the members of the American Ordnance Association, we have done it before. With your help, we will continue to maintain that marked supremacy that proved so decisive of victory in World War II.

In this talk I have necessarily devoted myself largely to a discussion of the material problems involved in our national defense, such as matters of production and industrial mobilization. But I could not approach the close of these remarks without some reference to the human beings behind our military program who ultimately determine the measure of its success. Civilian or military, in or out of service, these men, such as yourselves, who work so untiringly on our defense plans, are devoted Americans, citizens of a democracy, fathers of sons who would be in the vanguard of our armed forces if the shooting were ever to open up again.

The patriotic industrialists of our country at one time, even as I, were scurrilously referred to as "war mongers." That charge was rank libel then and would be now, for they are, on the contrary, now as then, the peace mongers of America, the hope of American strength. Upon them we shall rely for this strength that means safety to us.

I have talked to you about preparations for war. But in the last analysis, these are preparations not for war—they are steps preparing for peace so that a would-be aggressor will respect the strength of America and there will be peace.

And to you, my old friends of this Association who stood by me so loyally, I say that the job is complex, just as Jim Forrestal said in this room that night. It is difficult. A few short months ago it seemed to me almost impossible. But in those months I am happy to report to you we have built up a team. Steve Early, Deputy Secretary of Defense, who expected to be here and was stopped on a matter by the President at the last moment; Gordon Gray, Secretary of the Army; Frank Matthews, Secretary of the Navy; Stuart Symington, Secretary of the Air Force; Jimmie Burns, to whom I referred in affectionate praise—they are as fine a group of civilians as ever served this country in the Military Establishment.

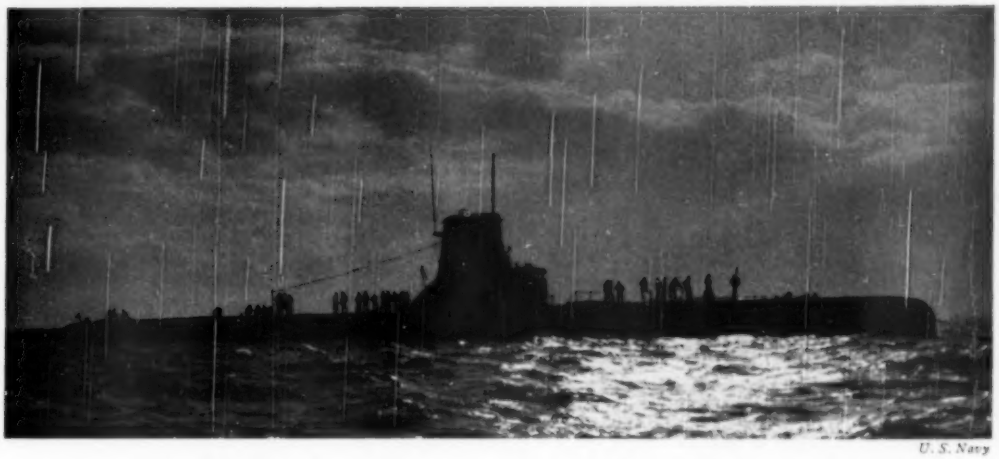
And over on the military side we have General Bradley as the captain and Chairman of the Joint Chiefs of Staff; Admiral Denfeld, General Collins, and General Vandenberg. There never were four officers in the history of the land who were better!

That is the team. It is functioning. It is a happy family. It moves on apace. There will be armchair strategists who won't agree with its decisions. There may be still around some of the terrorists who tried to scare me when I first went to this job at Mr. Forrestal's request. We shall pay no attention to the criticism that comes from such sources.

A Plea for Support

I ask you when you think this team, civilian and military, is right and when it fights for the strength of America—the military strength and the economic strength that must go with it to give us that combined strength that means peace for us and peace for the world—I plead with you, when you think we are right, rise up and give us your support. Give us the devil if you think we are wrong, but when there are vocal critics who don't know what it is all about, I pray of you who do, when we are right, to stand up and help us fight for a real America!

I conclude, therefore, men of this great Association, at your greatest banquet—and it is one of the greatest, I am told, in the history of New York City—with appreciation for the help you gave me in the past, with confidence that we have the best defense team in the history of America. I conclude, because you are part of that team, with a salute to you, the members of the American Ordnance Association, whose skill and production, matching your devotion to your country, serve so well to keep America sound and secure and to keep her respected and feared by any would-be aggressor, bringing peace through strength for ourselves and for our posterity. God bless you, every one!



U. S. Navy

Warfare under the Seas

Will the Submarine Replace the Surface Warship?

by

Lloyd H. Norman

Developments made in World War II have given the submarine much greater promise as the significant naval weapon of tomorrow's warfare

IN the age of atomic warfare, the one last place for man to hide is in the gloomy waters of the seven seas. The ocean is the great concealer, and that is why the submarine is increasing in importance as the nearly perfect naval weapon. The submarine's greatest asset is its ability to hide, to listen, and to wait—and then strike with the stealth of a footpad and with the deadly viciousness of an angry cobra.

Those who look ahead into the future of warfare are convinced that the submarine will become the primary instrument of naval attack. They will tell you that the submarine will remain after the big flattops, the battleships, the cruisers, and most other surface warships join the frigate and the galleon as museum pieces.

Here is why military strategists who are trying to prepare for warfare twenty-five years ahead are betting on the submarine: First, submarines pay high dividends in return for their investment. For every single unit of *M*[3] (men, money, and materials) expended, the enemy has to spend sixteen. Submarine experts discovered this "pay-off" ratio from World War II experience.

Secondly, submarines are in their infancy. Some day, according to Adm. Louis E. Denfeld, Chief of Naval Operations, they may become the "dreadnaughts of the deep," the capital ships of tomorrow. Eventually, says Defense Secretary Louis Johnson, atomic bombs may be delivered by submarines or pilotless rockets. Some atomic warfare experts, like Rear Adm. William S. Parsons, even foresee the day when submarines will launch globe-hopping rocket weapons with atomic warheads.

Thirdly, new true submersibles are on the way, with power plants which will give them extraordinary underwater speeds, making it extremely difficult to combat them. The new submarines will be able to lurk deep under the water's surface, perhaps out of reach of even the best listening and detection devices. They will be able to remain at sea for months, limited only by the physical, mental, and emotional endurance of their crews.

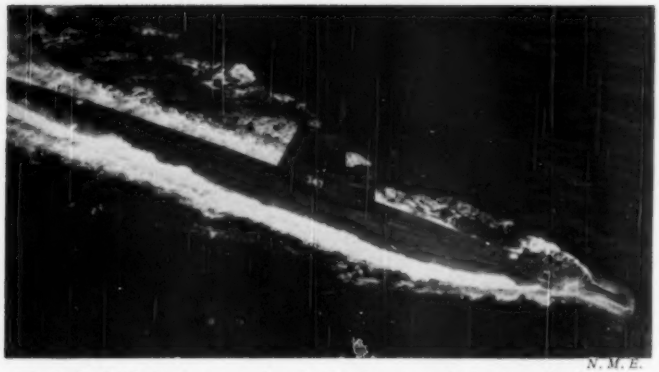
Cheap and Effective

Because the submarine is the cheapest and most effective naval weapon for its cost, nations will continue to use undersea weapons to fight wars. The submarine is especially favored as the naval weapon of "have-not" nations, and even wealthy nations, like the United States, pressed by mounting defense costs, are seeking economical weapons for the future. With our national defense costing us more than $100 per head compared with $8 back in 1938, we are becoming more interested in weapons which can win at the least cost.

Submarines, however, are not decisive weapons or instruments of mass destruction. They cannot win a war alone. Despite some extravagant claims made in Sunday-supplement articles, no one has designed a submarine which could knock out an enemy's fighting potential.

But submariners are confident that

Mr. Norman, now a Washington military correspondent for the Chicago *Tribune*, served as a naval officer aboard a minesweeper in the Pacific and in the command of Fleet Adm. Chester W. Nimitz on Guam during World War II.



N. M. E.

The hull of this Guppy-type submarine has been completely streamlined and is equipped with a "schnorkel" which permits Diesel-engine operation submerged.

the "pigboats" can cripple an enemy's ability to fight by disrupting his overwater supply lines, by raiding his men of war, and by forcing the enemy to expend prodigious and expensive efforts in combating the submarine.

Countermeasures Expensive

Millions of dollars must be spent by the enemy to fight the submarine with devices to detect and track the underwater raiders, along with large forces of destroyers, patrol planes, escort carriers, and other countermeasures. In the last war the United States Navy devoted nearly one-fourth of its research funds to antisubmarine warfare. The United States and Great Britain used more than 1 1/3 million men and about 100 billion dollars to conquer the German U-boat. Two world wars were nearly lost to enemy submarines.

Postwar strategy and scientific advances, mostly of German origin, have altered the submarine navy and its future place in warfare. The attack submarine of World War II now has a family of sister ships designed for special tasks. They are the radar-picket, cargo-carrying, troop-carrying, tanker, guided-missile, and hunter-killer submarines.

Versatile as a weapon, the submarine is being adapted by the Navy for different types of warfare, as follows:

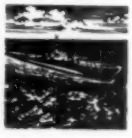
1. In antisubmarine warfare with special "killer" subs equipped with the finest underwater-detection and tracking devices and underwater weapons.

2. To attack surface ships in a campaign to weaken the enemy by destroying his overwater supply lines. This is strategic warfare like that waged by heavy bombers against an enemy's war industries and resources.

3. For radar picket duty, searching to detect enemy planes and missiles far out at sea with the latest electronic detection devices. These pickets would be linked with the Air Force's nationwide radar screen or would guard Navy task forces at sea.

4. For guided-missile launching and guiding near a hostile coast. Guided-missile submarines like the CUSK have launched the German V-1, a buzz-bomb type of missile, and other types of missiles in experiments at Point Mugu, Calif. The submarine BARB, in the summer of 1945, fired rockets against coastal towns of Hokkaido, Japan, in a prophetic employment of a new weapon. Other submarines are being developed to guide robot weapons to the target.

5. For lifeguard duty to save plane crews who have to abandon their aircraft at sea. During the war, submarines saved more than 500 Air Force and Navy fliers forced down at sea.



6. To mine enemy sea routes to disrupt shipping—another phase of strategic warfare.

7. For photo reconnaissance of enemy targets and movements from positions close to shore.

8. To land saboteurs, raiders, spies, and other undercover agents on enemy territory.

9. In evacuating personnel or valuable material trapped in enemy areas. The submarine TROUT carried the gold reserve of the Philippine Government from Corregidor to safety.

10. To carry troops for sneak attacks by large assault battalions to destroy vital enemy installations like rocket-launching sites. The Navy has converted two wartime submarines into troop carriers (SSP's) by removing two engines and torpedo tubes and by adding a tanklike hangar on the deck to carry amphibious equipment.

11. To supply support for sneak amphibious landings by the Marines, with submarines carrying cargo or gasoline. The Navy is converting several submarines into cargo (SSA) and oiler (SSO) types.

12. For mine-field reconnaissance to detect enemy mine-laying operations. Submarines, because they are concealed, can do this better than aircraft.

13. For beacon homing, using radar to guide planes or robot weapons to a target.

14. To report weather conditions near the enemy's shores.

15. For the control of aircraft patrols from submarines, a new development in naval air defense.

These types of submarine warfare now being developed reveal the new functions of the underwater Navy. The pattern of undersea warfare is changing. The enemy which the submarine must face in a future war is a new one, presenting new problems.

The new enemy (and enemy here refers to a hypothetical adversary because in peacetime the strategy and planning of war deals with shadows and guesses) is unlike Japan but like Germany. Soviet Russia may be selected as the object of our stragetic thinking because it is the only likely foe in a future war. It sprawls over the huge land mass of Eastern Europe and Asia. Unlike Japan or Britain or even the United States, Russia is not an island empire sorely dependent upon water-borne commerce for its lifeblood of raw materials and, in some instances, food.

Russia Self-Sufficient

Soviet Russia is the "most self-sufficient" nation in the world, according to geopolitical analysts. It has some deficiencies in basic raw materials, like tin, natural rubber, and petroleum. But these materials it can get either by overland conquest or through extension of its Communist system into places like Malaya.

Therefore it does not need a merchant fleet nor a navy for its protection.

Russia's big shortcomings are in technical skills, in the production of precision instruments and tools, in electric power and industrial machine resources. Obviously, the submarine can do little to make these shortages more acute and paralyzing.

This is the new strategic problem confronting the American submarine fleet: How to fight a land-based power that has a small, outmoded, third-class navy with 500,000 tons of ships, and with a tenth-ranking merchant fleet of 1,700,000 tons?

The Red Navy, according to American sources, has 250 to 300 submarines, but only a fraction of the Soviet submarine fleet consists of modern, fast, deep-diving vessels taken from the Germans or fabricated with the help of captured German engineers, tools, and plans. The Russians could not send out more than a squadron or two of far-ranging undersea raiders against American shipping in the next year or so.

With the Russians apparently emphasizing submarine warfare in their naval strategy, the No. 1 task of the United States Navy in a future war would be fighting Russian submarines.

Admiral Momsen recalls that American undersea craft during World War II sank 2 German U-boats and 23 Japanese submarines. British subs sank 19 German, 18 Italian, and 2 Japanese submersibles. Convinced that submarines may be one of our best antisubmarine weapons, the Navy is building three "killer" types (SSK) at a cost of 7.7 million dollars each.

New submarine developments now being adopted by the world's big navies are:

First, the "schnorkel," originated by the Dutch—a combination of exhaust and air-intake tubes which permit a submarine to operate its Diesel engines approximately fifty to sixty feet below the water's surface with only the "nose" of the schnorkel showing. With this device, introduced in 1944, the German U-boats threatened to win the Battle of the Atlantic.

Secondly, the "Type 21" U-boat with extra-large batteries and the schnorkel, of which the Germans built 120 by the end of the war but never used. These submarines could reach a submerged speed of 15 to 17 knots on their batteries or about 10 to 12 knots on their Diesels. American engineers who studied the Type 21 said it never went on a war patrol because its "hydraulic system was too clumsy and complicated." The Type 21 had a surface displacement of 1,600 tons, carried 20 torpedoes, a crew of 57, and had a maximum submergence depth of 360 feet. The United States Navy experimented with two Type 21 U-boats captured from the Germans and later incorporated its lessons in the streamlined "Guppy" class to which wartime United States fleet submarines are being converted. ("Guppy" stands for "greater underwater power propulsion.")

Thirdly, the Type 17 and Type 26 boats equipped with the Walter hydrogen-peroxide engine which could operate at high speeds for limited periods (about six hours) under water without any external breathing device, using its own oxygen supply. This engine allowed the vessel to operate deep below the water's surface.

Designed by Professor Walter, the hydrogen-peroxide engine had been tried before the war. The first experimental Type 17 went into operation late in 1943. It was a Walter peroxide engine removed from a Type 17 boat that our Navy brought to its engineering laboratory at Annapolis, Md., after the war for secret experiments.

The bigger Type 26 with the Walter engine was the German Navy's bid for victory—but it came too late. It was being built when the war ended. It was to have had a surface displacement of 900 tons, 10 torpedo tubes with no spares, a crew of 32, and a maximum submerged depth of 400 feet. The Type 26 was to have had three power systems; Diesels for surface operation at 14 knots, batteries for underwater speeds of 11 knots, and hydrogen-peroxide for emergency speeds of 25 knots.

Fourthly, the Kreislauf closed-cycle engine, a Diesel engine which uses its own exhaust gases supplemented by injections of pure oxygen from oxygen bottles. This engine permits deep underwater operation of Diesel engines without a schnorkel breathing device.

The "Guppies"

The U. S. Navy has adopted and improved the schnorkel and the Type 21 U-boat in converting twenty-four of its wartime fleet submarines into Guppy-type craft. The Guppies are being converted by streamlining through the removal of deck guns and other obstructions, by the installation of a schnorkel, and by the enlargement of battery-power capacity.

The Navy is still experimenting with the Walter hydrogen-peroxide and Kreislauf engines at its engineering laboratory at Annapolis. The peroxide engine, however, is extremely uneconomical because it requires peroxide that is ninety per cent pure, costing $15,000 an hour to operate. The highly concentrated peroxide also involves serious hazards because any impurity will ignite in the rich mixture.

The Navy's two new submarines, the TANG and TRIGGER, now being built at a cost of 21 million dollars each, will have Diesel engines but may later be adapted for some new types like the Walter engine or atomic power if it becomes feasible. An atomic engine is being developed for the Navy by the Atomic Energy Commission. Navy submarine experts have predicted that an atomic-powered submarine would be able to speed under water at 35 knots—as fast or faster than modern warships. Such a boat would be properly the first true submersible.

N. M. E.

This is a fleet-type submarine recently converted for troop carrying. The tank on the afterdeck is a watertight storage space for amphibious equipment.

Industrial Planning for War

Problems of Emergency Production Need Solution

by

John Slezak

"The problems confronting industry in planning for war consist primarily of knowing what is wanted, how much of it is wanted, and when it is wanted"

IN the preparation of these remarks I asked approximately thirty outstanding men from industry for their views on this subject. Every one of these men represents a company that was active in production of war matériel during World War II. Some of the companies involved are large, others are small—the largest employing approximately 30,000 people and the smallest some 200 people. Some of them dealt with only one service and others with several services simultaneously. Some of them produced products similar to their peacetime product—only in larger volume—and others were producing articles completely unrelated to their peacetime products.

There is one interesting conclusion that permeates these comments; namely, that men in industry have not only wholesome respect for the men in uniform but also a tremendous appreciation of their integrity and loyalty to our basic institutions. Our country is indeed fortunate that the officer personnel of our armed forces has such thorough understanding and appreciation of our free-enterprise system, not only as a military potential but also as a way of life. I do hope and pray that the Army, Navy, and Air Force will always remain *our* Army, *our* Navy, and *our* Air Force, and not organizations apart.

In time of emergency the job of industry is to help to convert the economic resources of the Nation into military strength in the shortest possible time. And what are the problems confronting industry in planning for war production? A subject of this magnitude cannot, of course, be adequately covered in the brief space allowed. I could discuss this subject by the hour, telling of the difficulties encountered in acquiring the "know-how" for the design and procurement of production gages and measuring instruments, of inspection problems, of getting deliveries on machine tools and materials, of overcoming difficult machining problems, of improvising production with old and obsolete machine tools while waiting for the new ones, of training management and production personnel, etc.

But all these are run-of-the-mill, prosaic problems which can and should be solved by good management as a matter of routine. However, it has occurred to me that I should rather deal with problems involving procurement and other agencies—problems not always susceptible of solution by industrial management alone. It has also occurred to me that you may enjoy seeing some of these problems through the eyes of the industrial leaders who cooperated with me on this survey. They may not always be right in their conclusions, but nevertheless that is the way they saw it. Perhaps "seeing ourselves as others see us" may have some constructive values.

At the risk of oversimplification I would say that the problems confronting industry in planning for war consist primarily of knowing what is wanted, knowing how much of it is wanted, and knowing when it is wanted. Simple isn't it! And yet most if not all of our major production difficulties during the last war originated in the failure of the military to give industry reasonably workable answers to these questions.

I understand and appreciate the problems brought about by the ever-changing conditions of war and warfare—the fluidity of war. But situations can become so fluid that they are all wet and nothing is effected but a sense of frustration!

For instance, in January 1942 a Midwest manufacturer was asked to quote on the cost of tooling up and the price per unit on the M7 light tank. The requested rate of production was 1,000 tanks a month. The job was extremely urgent, and tremendous pressure was applied to get delivery on these tanks in the shortest possible time—cost was no object. However, of the approximately 3,300 drawings covering this tank less than 900 were available, and after the contractor started working on this job he was receiving design changes at a rate of approximately one every 40 minutes!

The story of how this capacity was created—buildings, machinery, tools, production organization, etc., is in itself an epic. However, when all was ready for production in March 1943, the project was completely abandoned. Out-of-pocket loss to the Government was approximately $25,000,000, and there were other losses that cannot be quite so easily calculated in terms of money.

I could mention similar examples regarding artillery, small arms, and ammunition. For instance, on the carbine alone we received over 600 mandatory design changes after it was in production. Of course there was considerable

This article is based on an address delivered by Colonel Slezak before the Industrial College of the Armed Forces in Washington, D. C. He is president of the Turner Brass Company, Sycamore, Ill., a director of the American Ordnance Association, and president of its Chicago Post. During World War II he was chief of the Chicago Ordnance District.

improvement in this picture toward the end of the war.

Problem of Requirements

My survey indicates that the question of requirements was one of the very important problems that troubled industry. I am sure you will be interested in some of the reactions received from the manufacturers I have mentioned. Let me give you some examples:

"I know that because war is fluid the requirements remain in a constant state of flux. But I believe that this very truism was too often used as an apology to cover blunders which need not have been made."

"You are well familiar with all the procedures that had to be complied with in connection with procurement. Realize, then, what chaos was created in the individual business which frequently had to go through all the mechanical procurement procedures only to be told that the requirements no longer existed."

"Another evil effect of these 'false procurement alarms' was psychological. Those contractors who were unfortunate to have experience like this came to the belief that the War Department did not know what it was doing. A contractor so treated could usually be mollified once, or even twice, with the 'song and dance' about the fluidity of war, but after that he began to lose confidence, and with it, respect."

"If only one improvement, from the procurement approach, could be made in the future I would vote for intelligent handling of basic requirements as being the Number One benefit that could be accomplished."

I had, personally, many similar experiences, but one sticks in my mind more than any of the others. We were driven hard to produce certain medium tanks. We got everybody in high gear —unlimited overtime—no Sundays or holidays off. I personally spent New Year's Eve with workers at their machines. They wanted Christmas and New Year's Days at home with their families but were persuaded to stay on the job.

We met and exceeded our schedule, but on January 2nd we were told to stop all shipments. We were at a loss how to explain this to our employees and the community. It must be remembered that without the wholehearted support of the American people our maximum ability to produce can never be realized.

"Carrying the load placed on industry in wartime essentially involves, men, money, and materials. Of these the most important element is men, because if the problems of men and organization are handled well the other problems become of secondary importance or tend to disappear entirely."

If we had unlimited resources of men and materials, this type of situation would be foolish and in time of war would be of relatively small importance. But with our limited resources, unrealistic requirements are not only wasteful but can cause tragic consequences.

Men, Money, Materials

Carrying the load placed on industry in wartime essentially involves men, money, and materials. Of these the most important element is men, because if the problems of men and organization are handled well the other problems become of secondary importance or tend to disappear entirely.

If we had men in the procurement agencies who not only knew what was wanted but had the ability to convey this understanding to industry and make sure that industry's interpretation of specifications, etc., was what the services wanted it to be, our problems in preparation for war production would be relatively simple.

And if industrial management were so organized as to be capable not only of rapid expansion of management functions but also of corralling the constructive forces of their respective communities so as to be able to utilize them in fulfillment of their mission, the problems that we are talking about would virtually disappear.

Proper organization can go a long way toward making even mediocre men function effectively, and competent men frequently can get the desired results in spite of poor organizational setup.

Some of the production problems caused by poor organizational procedures and by men not equal to their jobs are indicated by some of the typical comments I have received:

"There was one period when we had to satisfy six different inspectors from six different services on the same spare part. That certainly does not make for efficiency, and it didn't help a critical man-power situation either when those six different inspectors did not have a single common way of achieving their own particular missions."

"Based on our experience, we think that there must be a better coördination on inspection between the armed forces inspectors, prime-contractor inspectors, and subcontractor inspectors. Time and time again we had the experience, on the same part, of satisfying our prime-contractor inspector but not the armed-forces inspector, or vice versa."

"Inspectors from one branch of the service should not be made responsible for inspecting work going to another branch. We found in such cases that the inspector was much more afraid to make decisions, feeling that he might be more quickly criticized by the other branch."

"Procurement personnel should be selected more carefully in line with their responsibilities. We had illustrations of stock brokers attempting to negotiate and purchase all sorts of technical items, with practically no knowledge of engineering drawings or production operations."

"All kinds of procurement officers descended on industry. Many had little or no experience in manufacturing, and it appeared at times that out of pure frustration they were looking for some one to 'tag' with a contract."

"We had many weeks when several auditors from several different services were here at the same time. These auditors did not accept each other's audits or findings."

"There is one thing which we certainly think would be helpful to industry in general and that is the establishment of adequate procedure under which the consideration of deviations from any standard could be expedited."

Lack of Authority

This last comment brings to my mind the difficulties caused by faulty organizational setup. It happened again and again that the individual responsible for production results did not have adequate authority over all elements of production to accomplish his mission. Let me illustrate by an incident from my own experience. At one period during the war the production of 8-inch shells was on the critical list. We were told to move heaven and earth to produce these shells. I was with a War Department official in the office of the president of one of the companies manufacturing 8-inch shells. Chief among the reasons for not meeting the production schedules that this man gave was that the War Manpower Commission would not let him hire enough men to meet his requirements. The War Department official then turned to one of his aides and directed that this company's allotment of men be changed at once to the number requested by the manufacturer.

It was obvious that this official, even though he was responsible for production results, did not have authority to issue such an order. This is what happened: The local Labor Management Committee of the War Manpower Commission refused to budge and was sustained by its regional director and finally by Mr. McNutt himself.

In the meantime, days and weeks went by with no constructive results. Finally I personally managed to sell the local committee on changing its stand. That, by the way, is in itself an interesting episode of problems confronting industry in planning for war production. I am sure that you have seen the sequel to this story in the newspapers several months ago.

Let me close this phase of the subject with another comment from my survey:

"On the positive side of procurement, I would like to mention that for efficiency I believe the solution to be decentralization and more decentralization. As I see it, the central office, so to speak, should serve only two broad purposes: first, to disseminate the requirements and, secondly, to act as a service agency in supplying the basic legal ground rules and up-to-date national price information. It almost always followed that when Washington got mixed up in procurement, confusion resulted. I realize that the political pressures to which the 'main offices' were subjected by virtue of location makes complete decentralization a difficult problem, but I strongly urge that we should be working toward making the Washington office of all the branches highly efficient service agencies to assist the field offices in the actual procurement work."

I personally believe that decentralization of operations and delegation of adequate authority to the individuals involved would have eliminated many delays and unnecessary and costly nuisances. In the Ordnance Department we were very fortunate in this respect. The Ordnance district chiefs had adequate authority to do the job well and were close enough to the contractors to bring about friendly cooperation and mutual understanding. I think that industry could well emulate many of the operating practices of the Ordnance Department during the last war.

Selective Service Troubles

The operation of Selective Service caused many unnecessary headaches, and in the next war it may prove to be too costly a luxury. This is the way some of my friends in industry feel about it:

"The loss of personnel from our two plants through the draft was terrific. Out of approximately 1,600 employees we lost over 600 to the armed forces during the war period. In many cases these men were the 'cream of the crop' for production. We were up against one or two draft boards that simply didn't do an intelligent job on deferments."

"The individual inequities which resulted from the use of men were so flagrant that I can only hope for their correction through some kind of national service law which will view all our available man power as one pool from which assignments will be made solely upon the consideration of the good of the state in time of emergency and not upon benefits to the individual."

Problems of Renegotiation

The problems caused by renegotiation created confusion on the part of some contractors and dismay on the part of others. On one hand there was tremendous pressure against cost-plus contracts as being against the best public interest, while on the other hand all contracts, by the virtue of statutory renegotiation, became cost-plus contracts. In my opinion, renegotiation in a free democracy can never become a successful substitute for intelligent buying. Here are a few comments from my survey about this matter of renegotiation:

"Renegotiation in general seemed to dull the edge of incentive for smaller companies. It was difficult to understand, and you never knew what it did to you until a long interval after the contract was well in progress or completed. You never knew whether or not you would lose some of your skin with your shirt. There was neither protection in case of loss nor much credit for doing an outstanding job."

"Actually, as you are well aware, over-all renegotiation was defeated *per se* in those many cases where a contractor performed inefficiently on one contract and efficiently on another. Actually, to accomplish the purpose of saving labor hours and materials the whole system should be set forth and administered as an incentive rather than a deterrent to the contractors."

In conclusion I believe that the solution to most of these major problems lies in setting up organizations both in procurement agencies and in industry that can accomplish their wartime missions although in an atmosphere of confusion and when manned by the type of personnel they are most likely to get in time of major emergency.

A Study of The Man at War

A Psychological Analysis of the American Soldier

by

Edward A. Fitzpatrick

A critique of four volumes dealing with the behavior of the American citizen under the fatigues and the pressures of wartime service

LOOMING on the horizon of military literature is the monumental work of Samuel A. Stouffer, *et al.*, "The American Soldier," Volume I of which deals with "Adjustment during Army Life," and Volume II with "Combat and Its Aftermath." The books are published by the Princeton University Press. These are part of a 4-volume series of studies in social psychology in World War II being sponsored by the Social Science Research Council. The other two deal with experiments on mass communication (Volume III) and with measurement and prediction (Volume IV).

The basic content of the two volumes available concerns the attitudes of American soldiers during World War II both in the United States and in the overseas theaters of operation. They contain a great body of information based on numerous questionnaires on soldier attitudes toward the Army, but the primary interest is in the methodology of social psychology.

The material was originally collected in the Research Branch of the Information and Education Division of the United States Army. This material has now been made available to the Social Science Research Council. The data are not new but have been worked over with assumptions, conceptions, and other intellectual tools. More attention should have been given to the problem of presentation and the principles of exposition.

An introductory statement says: "In making the data available, the War Department assumes no responsibility for the analyses and interpretations contained in these volumes, which are the sole responsibility of the authors."

Though the volumes were prepared under a grant by the Carnegie Corporation, "that corporation is not, however, the author, owner, publisher, or proprietor of this publication, and is not to be understood as approving by virtue of its grant any of the statements made or views expressed therein."

However, in a foreword, Frederick Osborn, formerly major general director of the Information and Education Division, enthusiastic about the report, calls this study of attitudes unique. He says, "Never before had modern methods of social science been employed on so large a scale, by such competent technicians." In view of the Crosley, Roper, and Gallup Polls, which used the same techniques and methodology, this is a fairly strong statement.

One wonders, also, at the statement in the foreword that in no other country could there be found so many men with such a high level of training in modern techniques for influencing the behavior of human beings. The Germans under Goebbels were using these and a whole lot of additional techniques with surprising results in the direction and control of human affairs.

Mr. Fitzpatrick is president of Mount Mary College, Milwaukee, Wis., and is a lieutenant colonel in the Ordnance Reserve. Since 1946 he has been a member of the advisory board of the Industrial College of the Armed Forces.

So much for those who are sponsoring the report and accepting the responsibility. The fact is that the report was made by military and draft-deferred civilian personnel in the Information and Education Division, and the leaders in these studies are now working them over under the same supervision in the name of the Social Science Research Council. The responsibilities are now theirs as civilian social scientists.

Three Audiences

The authors explain that the books are written for three audiences: the military, the historians, and the social scientists. It is really for the third group, however, that the volumes are produced.

"If either the armed forces, on the one hand, or the historians on the other, were to be the sole audience for these books, somewhat different procedures of organizing the primary materials would have been adopted. But there is a third audience—of social psychologists and sociologists—and this is the main audience to which these books are addressed. The study of personal and institutional adjustment to new social situations may be stimulated both by the findings in these volumes and by their shortcomings" (Vol. I, p. 4).

This explains the barrier for the general reader which the first fifty pages make because of the preoccupation with the methodology of social psychology and its struggling efforts to become a science.

One may see clearly that the authors of these volumes are especially conscious of the pioneering character of the work, the weakness of its bases, the inadequacies of its methods, the tentative character of its results—and yet of its great exploratory value. If the volumes are read in this spirit they should be suggestive and stimulating not only to social scientists but also to military personnel and should furnish leads for the historians. For example, we read:

"We need in social science much more frankness than is customary as to the limitations of comparisons which use only segments of the controlled-experiment model. In Volumes I and II an attempt has been made to call attention to such shortcomings, but this could not be done adequately without repeating a warning on almost every other page. In the present stage of social science, and perhaps for a very long time to come, data of the type which constitute most of Volumes I and II are likely to be staples of social research. Our habits of thought are such that plausibility of an inference from a table of association or even from two illustrative cases is all too beguiling. Hence the need for candor" (Vol. I, p. 48).

In the preparation of these volumes the writers found several fields of knowledge helpful in their effort to develop social psychology to a point from which it is hoped empirically verifiable inferences and predictions can be made. These fields are dynamic psychology, the psychology of learning, Freudian psychoanalysis, social anthropology, and the other social sciences.

Some of the useful conceptions drawn from these fields are: (1) the idea of the human being as controlled by drives and wishes, often unconscious rather than rational, (2) the Pavlovian conditioned reflex and controlled experimentation, (3) social mobility, (4) mass multiple memberships in organizations, and (5) the nature of social institutions, social change, and social control. In the present stage of the social sciences it is imperative that all these conceptual schemes be kept open and their unity realized.

Attitudes of Soldiers

In Volumes I and II the main facts concern the attitudes of soldiers as determined by their response to questionnaires which are then analyzed from the variations of Army experience and personal background.

Volume I deals with the general problems, more particularly with adjustments of the old Army struggling to adjust its traditions to what are considered the new methods of modern war. This includes such questions as: "What type of men were best adjusted? What kind of men were psychoneurotic and disciplinary failures? With what conditions were men satisfied and dissatisfied—with immediate jobs and assignments, or with leadership and orientation problems?"

"Volume II considers the motivations and attitudes of combat troops in Ground and Air Forces and deals with the aftermath of combat—neuropsychiatric manifestations, problems of returnees from overseas, initial problems of occupation in Germany, and attitudes of the soldier toward his Army experience and toward his civilian future as he laid down his weapons for the last time" (Vol. I, pp. 52-53).

Volume III analyzes the problems involved in experimental studies. Changes and responses are studied in the framework of control. Volume IV gives a detailed account of sampling and field work. It reviews the methodological problem of method and product and states the fundamental concept or attitudes—"the most important single methodological contribution" of the study. It points out that people who have extreme opinions hold them most intensely.

After the initial difficulty was overcome of a prohibition of such studies by the Secretary of War at the beginning of World War II, the Research Division had a hard time in breaking down what they regarded as a lack of coöperation. A representative in the Civil Service Commission cut the red tape for them there. Representatives of the War Manpower Commission and of the War Department Committee of Deferment of Federal Employees are said to have saved the organization from what might have been the "arbitrary" application of the Selective Service regulations.

This, I presume, means that the representatives of the Selective Service System—or were they representatives of the President?—wanted to put members of the Research Division in the Army instead of letting them stay in the Pentagon. Especially appreciated by this group were the services of an Army officer "whose knowledge of Army ways and whose vigorous and resourceful tactics in using Army machinery to accomplish ends for which the machinery was never devised were . . . indispensable to the establishment of this research within a military framework" (Vol. I, p. 13).

The backbone of the work consisted of questionnaires filled out anonymously by a representative sampling of soldiers. These questionnaires were supplemented not only by informal inquiries but also by making as much use as possible of operating statistics collected by other agencies. In this connection it is worth noting "that the statistics

on such matters as courts-martial, absences without leave, official ratings of officers, and the like were not too helpful." The questionnaires were also supplemented by informal findings and by operational statistics.

The authors say that the "value of qualitative and impressionistic 'casing of the situation' was recognized from the beginning" (p. 38). Though of course the method adopted was made necessary by the fact that many of the problems could not be treated on an impressionistic basis, there is recognition of the basic difficulty that on the principal terms with which the study was dealing there was no agreement.

"Although in the main work of the Research Branch and in most of the text of the present volumes there is no precise operational definition of attitudes—whence concepts like 'attitudes,' 'tendencies,' and 'opinions' were used more or less loosely and even sometimes interchangeably—the need for fundamental studies leading to ambiguous operational definition of attitudes in terms of measurement was recognized from the beginning" (Vol. I, p. 42).

As in all questionnaire studies there was careful pretesting of questions not only to find the best wording but also to discover the kind of questions that should be asked.

The "Old" Army

It is greatly to be regretted that within the space limitations it is not possible to give the concrete illustrations and results of the studies on such a wide range of subjects as, for example, the contrast of the old Army and the new. The "old Army" being described as follows: "Its authoritarian organization, demanding rigid obedience. Its highly stratified social system, in which hierarchies of deference were formally and minutely established by official regulation, subject to penalties for infraction, on and off duty. Its emphasis on traditional ways of doing things and its discouragement of initiative" (Vol. I, p. 55).

Detailed problems discussed included personal adjustment and social mobility in the Army, especially promotion, job assignment, and job satisfaction; attitudes toward military leadership; and social control—the preparation and orientation of soldiers for war. Individual comments—critical and favorable—to the Army are striking and at times unquotable.

There is an extensive discussion of the Negro soldier. The things that stand out possibly most clearly in this comprehensive statement are: (1) type of preference for officers, (2) in what camp he would like to be, (3) what branch of the service he would like to be in—all permeated by the strong reaction to race discrimination. It is in terms of this that practically his whole attitude toward the war and Army organizations is expressed.

Combat and Its Aftermath

The second volume in 650 pages deals with the American soldier in combat and its aftermath. It includes the same methods and the same techniques as in the preceding volume but now applies them to a soldier with combat experience. The opening chapter deals with the attitude before combat and behavior in combat. The next three chapters deal with the problem of ground combat—the general characteristics of combat, the motivations of ground troops, and the problem of control of fear in combat, developing somewhat John Dollard's remarkable study of this same reaction, "Fear in Battle."

The fifth chapter deals with the combat replacement who is called the "orphan of the Army." The final chapter in this series on the ground soldier deals with the attitude of the combat soldier toward the rear echelons and the home front.

The next division of the report deals with the Air Force. The first of the two chapters deals with the morale attitudes of combat flying personnel in the Air Force and the second deals with the objective factors relating to morale attitudes in the aërial combat situation.

Psychoneurotic Symptoms

The next division of the report deals with the psychoneurotic symptoms in the Army of which we have already heard very much and of problems of rotation and reconversion of overseas personnel. The following division deals with the problems of redeployment and the postwar situation.

The first chapter of the final group in the series discusses the point system for redeployment and discharge which the social scientists are very proud indeed of having developed. There is no analysis of the preliminary studies in this field but at any rate the achievement is highly regarded. These studies, it must be noted, were responsible only for the *order* of the deployment and not for the *rate* about which a great deal of the "howling" centered. Chapter XII deals with the aftermath of hostilities and the final chapter of this lengthy volume with the soldier as a veteran.

These two volumes furnish a mine of information. There are gropings for a psychology, particularly a social psychology of man, which are, in the opinions of the authors, only first steps. Much of the material will raise questions in every one's mind as to its adequacy. The nonverbal behavior tests show great ingenuity but may be generally questioned. The items entering into the various attitudes and tests of achievement could be discussed for hours without definite conclusion, as indeed they are discussed at some length in the book.

Not Too Original

At any rate, the volumes are suggestive. These are not so strikingly original as the sponsors think they are in the application of techniques used for some time in education, in public-opinion polls, and in market analyses. One can understand the objection of the Secretary of War in 1941 to authorizing such polls. Questions might still be raised whether the introduction of such polls crystallize opinions of the soldier or initiate attitudes which he seizes upon to satisfy his mental situation. They are obviously suggestive for an intelligent leadership within the Army to correct these conditions.

It should also be noted that these studies of attitudes as published furnish a good means for effective work by subversive and infiltrated groups within the military forces. We must recognize that if they may be used one way they may also be used in another way. The remaining two volumes are really concerned with an evaluation of the techniques used. They will undoubtedly strengthen an attitude which exists through the report—the humility of the authors and a high hope for a "science of man."

Air Force

America's Air Defense

Radar Will Play an Important Part In Spotting Any Aggressor Aircraft

by

Maj. Gen. Gordon P. Saville

Commanding General of the Air Defense Command, U. S. Air Force

"As an enemy develops mass-destruction weapons, it becomes vastly more important for us to destroy the bomber before it reaches the bomb-release line"

A DISCUSSION of air defense might well start with a review of the major tasks of the United States Air Force. These are generally broken down into five categories: (1) strategic air offensive, (2) air transportation, (3) coöperation with ground forces, (4) coöperation with naval forces, and (5) air defense.

Air defense, then, is one of five "Tactical Systems" shown in Figure 1. The circular area represents the means which are available to the Air Force at any given time to accomplish its tasks. Although the five sectors of the circle are shown equal in size, this is not necessarily always true. The point we are attempting to illustrate is that the means can be put into the air-defense system only at the expense of other systems. It has been our experience that the over-all limitation of means is present in peace as it is in war.

Next, let us examine the relationship between our air defense and a potential enemy's air offense. Figure 3 is an attempt to show this relationship graphically. The two spheres represent the United States and an enemy, each waging an air offensive against the other and each conducting an air defense as well. The prong labeled "Air Defense," in each case is rooted in the geography it is designed to protect, but it is pointed at the enemy prong marked "Air Offense."

The significance of this chart is that the enemy's finger can be directed and pointed wherever he wants—he can choose the time and place to attack. Wherever the finger is pointed, the opposing air defense has to follow along and attempt to pinch off the end marked "strikes." The basic orientation of air defense, therefore, is dual in nature. It is rooted in protection of the defended area and pointed at the enemy's attack. This dual orientation complicates the problem appreciably.

Let us now consider the "defense aims." Ideally we should, of course, destroy all the enemy's bombers before any bombs are dropped. In the past, however, to destroy enemy bombers on the way home was also desirable, thereby preventing them from returning with new bomb loads. Finally, air defense was of value even if it succeeded only in harassing the enemy on his bomb run, making his aim poor.

As an enemy develops mass-destruction weapons, it becomes vastly more important for us to destroy the bomber before it reaches the bomb-release line. We can still, on a long-term basis, derive some benefits from the attrition imposed on enemy aircraft after bombing. But to accomplish the protective aspects of air defense, the kill must be accomplished before successful bombing.

For defending large land areas, such as the United States, the fighter airplane is our most useful and versatile weapon, due largely to its range and mobility. Local defense weapons, such as antiaircraft artillery, contribute materially to the total air defense, but they cannot be the basic weapons of a large land-area defense. The fighter, furthermore, must be employed from a ground-alert state. We cannot afford to cover tremendous areas with constant air patrols and still have any forces left for any of the other tactical functions.

Naval Air Defense

Probably the greatest concentration of air-defense means ever known was employed by the U. S. Navy in defending their carriers against the Japanese Kamikaze attacks during the closing months of the war. In that case, they could afford many things—continuous air patrol, outlying radar pickets, and immense quantities of antiaircraft artillery—because the effort was limited in time and in space. The same degree of defense-per-square-mile applied to the continental United States would be ruinous economically.

The fighter is useful because it

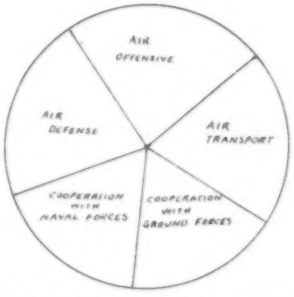


Fig. 1. Tactical systems of the Air Force.

intercepts bombers. It is important to understand the time and space relationships of the interception initiated from

ground alert, because it explains the need for a radar warning system, among others.

Figure 2 graphically depicts a typical interception. At the time, *zero*, the fighter is on the airfield in the lower left-hand corner, and an enemy bomber has just been detected by our radar warning system crossing the vertical line, *X-X'*. The distance *A* traveled by the bomber represents the time elapsed while we decide whether the newly detected aircraft is a friend or an enemy, the possible threat is evaluated, and orders to take off are transmitted to the fighter.

At the end of this time the fighter takes off and climbs to the bomber's altitude along the line *B'*. During the fighter's climb, the bomber covers the distance *B*. The fighter, having attained the proper altitude, accelerates to level-flight speed and flies to the point of interception, covering the distance *C'*. During this interval, the bomber covers the distance *C*. Interception takes place along the hypothetical vertical line *Y-Y'*. It could be said, therefore, that the earth's surface lying to the left of, or behind, *Y-Y'* is the "defended area," whereas the area in front of *Y-Y'* cannot be defended by fighters.

Objective Is Clear

Several things are immediately apparent from this oversimplified schematic representation of the intercept problem. Obviously it would be better to detect the enemy further out—in other words, if the line *X-X'* were moved out to the right. This is a function of the capabilities of our radar system which I will discuss in more detail. It would also be helpful if the enemy were slower or if our own fighters climbed faster.

The first thing that occurs to us is to increase the power of our radar. But this is useful only up to a certain point, for radar waves travel in straight lines and unfortunately do not follow the earth's curvature. What we want to do, therefore, is to increase our present inadequate coverage up to what we require. Beyond that, however, increasing radar power succeeds only in increasing our coverage out in the general direction of the moon and contributes very little to solving the intercept problem. The only way we can help ourselves is by the tactical forward deployment of another radar network.

A plan view might be helpful. Figure 4 shows the horizontal coverage

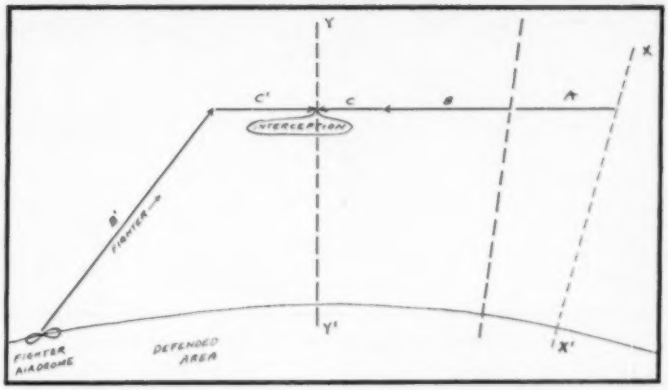


Fig. 2. The time and space relationships of aircraft interception.

at one particular target height obtained from several radar stations. Radar locations are shown by circles containing crosses, and fighter bases by propellers. The outer dotted line is the outer limit of early warning, and the inner dotted line is a theoretical "intercept line."

When an enemy is discovered on the outer dotted line, regardless of the direction in which he is going, he can be intercepted on the boundary of the defended area. If the radars could reach out further, the line of possible interception would move out further. If the airdromes were located further apart, the salients extending into the defended area would be deeper.

A situation often arises where an important target lies just outside a general defended area. To protect this target we can either add a fighter base or extend the early warning by adding a radar station. The latter course is usually cheaper.

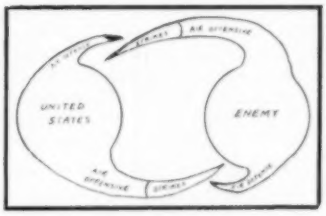


Fig. 3. The dual rôles of air warfare.

It appears, then, that there is a definite geographic relationship for any desired degree of protection between the outer limit of early warning, the lateral displacement of fighter airdromes, and the area to be defended. From the facts presented thus far, it might appear that a good deal of the problem could be solved by putting out early warning stations where required. It would also tend to indicate that if a little warning is a good thing, a lot of early warning must be a lot better. This is not true. Let us see why.

Take for example a coastal area with two fighter airdromes and a number of GCI (ground control of intercept) radars along the coast. Assume that we have early-warning radar coverage obtained from some picket vessels an appreciable distance from the coast. Now let us assume that an enemy is detected by the early-warning coverage of the picket-vessel line and tracked across it headed for one of our two airdromes. We have ample early warning, we think, and promptly scramble fighters from that airdrome to intercept.

But just about the time our defending fighters have started to climb, the bomber has passed through the picket line's radar coverage. The next time we know of him is when the land-based radar of the main GCI line picks him up, and, obviously, because continuity of surveillance is lacking, this can be almost anywhere—perhaps too far away for our airborne fighters if the enemy has purposely flown a dog-leg.

Still, the picket line with advanced early warning has great utility in a point-defense situation where there is only one relatively small target area to defend. For example, a naval task force at sea, by throwing out a ring of radar

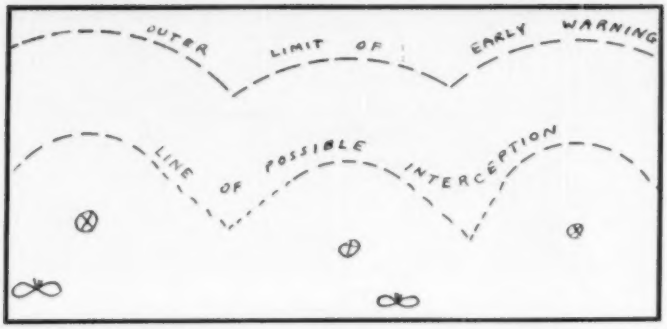


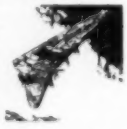
Fig. 4. Horizontal coverage obtained from several radar stations.

pickets, can gain necessary warning very nicely. If an enemy is detected crossing the ring we prepare to defend the task force. If he does not approach the task force, we are not interested.

On the other hand, should the area be the East Coast of the United States between Boston and Washington and should an enemy be detected crossing the picket line headed for New York, we would have to alert defenses everywhere to be certain of interception, thereby defeating the purpose of the line in the first instance.

A correct deployment of picket vessels for land defense will bring the ships closer to the coast line. Range will then be sacrificed for continuity of tracking, but the system will always work if we can watch the enemy continuously.

The terms "local-defense situation" and "general-defense situation" are worthy of some elaboration. The local-defense situation might be typified by an island containing the defended objective, an airdrome, and a radar station. In this situation, any one detected by our radar is either headed for the island—in which case we want to intercept him—or he is going to bomb the ocean—in which case we are not alarmed.



In an area-defense situation, on the other hand, the enemy must be assumed to have a choice of lucrative targets, dispersed or in a large area. It is important in this case to design the radar net to provide continuity of tracking after initial pickup and to so deploy and design the fighters that some of them intercept anywhere in the outer defended area.

Regardless of whether we find ourselves in a "local" or a "general" air-defense situation, however, the method of conducting air defense might be approximately the same. Let us trace through a typical mission in the defense of a large land area as we visualize it several years from now.

A Typical Defense

We have seen that basic principles compel us to operate from a "ground alert" with ground control of fighters. This implies that there will be in operation an extensive radar net composed of early-warning radars, GCI (ground-control and intercept) radars, and air-defense control centers. The early-warning radars will be continuously scanning the air space assigned to them and will be tracking all air traffic. They will have access to flight-plan information on all friendly aircraft to facilitate proper identification. As a check on this method of identification there will be an electronic IFF (identification, friend or foe) system, by which the ground radars can challenge particular aircraft and receive a coded response revealing their identity.

Let us assume that a target has been detected on which we have neither an advance flight plan nor, upon IFF challenge, a correct reply. If the station first seeing the target is an early-warning station, this information of the presumed enemy raid is immediately relayed to an appropriate GCI station in the projected path of the raid and to the area control center.

At the control center there are civil and militray liaison officers from the flight-plan-granting agencies such as CAA and Military Flight Service. While the GCI station is dispatching an element of its assigned fighters to investigate and intercept the raid, these liaison officers check back to make sure there was no error in identification. Again let us assume that no agency claims the aircraft in question and it is to be considered hostile until intercepted when—depending on the state of alert of the whole air-defense system, previous intelligence information, etc.—there might be a last-minute visual or electronic check before the fighter starts shooting.

During all this time the enemy raider is proceeding toward the defended area, and the fighter has started to climb toward him, under ground radio control from the GCI station. Shortly the enemy will pass out of the early-warning radar coverage and penetrate the coverage of the GCI. A duty controller at the GCI station has been assigned the conduct of this particular interception. He has access to air-ground radio at his control scope and is able to direct the fighter.

If the mission takes place in clear weather and good visibility, the fighter pilot soon reaches a point from which he can see and visually identify the enemy, take control of the situation himself, and proceed into his final gunnery approach. If the interception takes place at night or in bad weather, his airborne radar detects the enemy and the final approach is made under airborne radar control.

Eventually we look forward to target-seeking or ground-controlled ground-to-air missiles which may have high kill probabilities. But with the presently contemplated short range of such missiles, they will very likely be local-defense weapons, and at some date in the future there may well be a merger between the fighter and the guided missile. An uninhabited automatic fighter may be launched, climb rapidly to the point where its airborne radar locks onto a target, and it in turn will then launch air-to-air guided missiles to destroy the enemy raider.

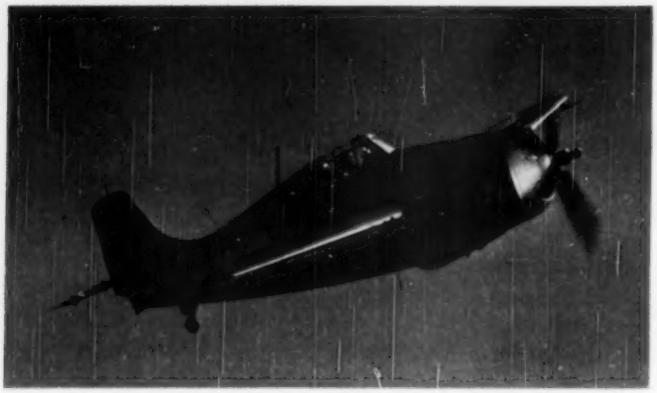
But the key to success will always be *teamwork*—teamwork of military planners and industry in producing the best in aërodynamics, electronics, and armament—teamwork in operation and teamwork in supply, maintenance, and logistic support.

(General Saville delivered an address on this subject before the New York Post of the American Ordnance Association recently. C. Stewart Comeaux is president of the Post.—The Editors.)

Wings for the Navy

The Growth of

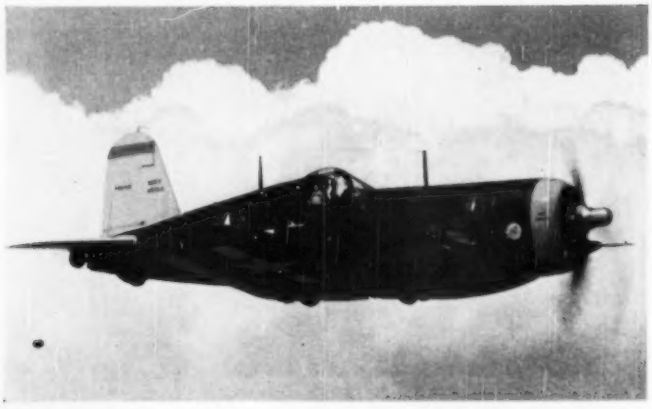
DESPITE periods of public apathy, through the years the United States Navy has demanded the top performance of its men and aircraft and maintained the highest standards of operation. In the grim days following Pearl Harbor, Navy airmen, aircraft, and carriers were able not only to parry Jap attacks in the Pacific but soon went on the offen-



The staunch Grumman F4F played an outstanding rôle in the early days of the war in the Pacific, although it was outclassed in some respects by Japanese fighters.

Outwardly resembling the F4F, the F6F is more heavily armed with 6 caliber .50's and is powered with a 2,000-h.p. engine.

The PBY "Catalina" patrol bomber has had a miles, it tracked the BISMARCK to its destru



The 400-mile-an-hour F4U-4, armed with 6 caliber .50's not only was a match for Japanese aircraft but also performed successfully as a fighter-bomber.

The Grumman "Avenger" torpedo-bom explosives at a top speed of 270 mile

'aval Air Power

sive—dealing blows that kept the enemy off balance until America could bring crushing forces to bear.

But our Navy is not resting on past laurels. It continues to demand the highest standards. The aircraft shown here from official Navy photographs prove that it has kept pace with the most advanced scientific and technical developments.

The F8F "Bearcat" (top) the latest conventional fighter, has a speed of over 450 m.p.h., a range of 2,000 miles, and carries six .50's and rockets. The "Panther," Grumman's 600-mile-an-hour jet carrier fighter (bottom), is powered either by the Rolls-Royce "Nene" turbojet engine or the Allison 400 (J-33) turbojet.

distinguished record. With a range of over 2,400 tion and torpedoed several Japanese cruisers.

The AD-1 Douglas "Skyraider" is almost a flying battleship. It carries twelve 5-inch rockets and two 12-foot-long, 12-inch "Tiny Tims" besides conventional armament.

er which can carry 2,000 pounds of high an hour was effective against the Japs.

A new addition to the fleet is the Piasecki XHJP-1 tandem helicopter. It will be used for observation, plane guard, personnel and cargo transport.

The F6U "Pirate," above, 500-mile-an-hour fighter, is powered by a single jet unit and is qualified for carrier operations. Above right, having successfully met the Navy's rigid carrier operations tests, the FH-1 "Phantom" now serves with the fleet. Right, the D-558 "Skystreak" is the Navy's transsonic-speed jet research airplane.

A radical departure from conventional designs is the tailless jet fighter, XF7U-1 "Cutlass," left. Twin jet engines give this plane a 600-mile-an-hour-plus top speed, and is one of the first jet carrier planes to have swept-back wings.

One of the "big boys," the Martin XP4M-1 patrol bomber, right, is powered by 4 engines—2 conventional piston engines and 2 jet units mounted in the same nacelles. With 8 crewmen, it has a top speed of 350 miles an hour, a range of 3,000 miles.

The "Truculent Turtle," a plane of this P2V class, flew from Perth, Australia, to Columbus, Ohio, nonstop.

The biggest of the "big boys." The XR-60 "Constitution" can carry 180 people at 300 m.p.h. for 3,000 miles.

Procurement Looks at Research

Industrial Security Depends on the New—Not the Old

by

George S. Brady

"The time has come when American businessmen must take the rôle of economic statesmanship. They no longer must be satisfied with the mere phase of production of goods and service. They must recognize their responsibility to the economy as a whole."—*Alfred P. Sloan, Jr., November 28, 1944.*

IN a previous article published in the September-October issue of ORDNANCE I tried to indicate by a few examples that large stocks of strategic materials are incompatible with progressive research and that administrative judgment is likely to be warped and scientific initiative stagnated by such stocks. I also indicated how the nobles of the fourteenth century were against the introduction of iron cannon into England because they were equipped to make oak catapults. But, like Maj. Gen. J. F. C. Fuller, who likewise champions unpopular causes (see his article also in the September-October issue of ORDNANCE), I do not want to be misunderstood.

Since World War I, I have advocated stock piles, but as one somewhat familiar with industrial procurement, I fear excessive stocks. I like sugar, but I would not care to eat five pounds of it. The next war (and there is no other reason for materials' stock piles) is not going to be fought with the methods of 1945. Superiority will not be gained by stocks of the old, but by facility in devising the new and by an administrative ability to change our system quickly to adopt the new.

Science has already advanced so far and we already have so many products to make living comfortable that, if we could have continual peace, the human race could get along nicely on the things now in hand, coasting along leisurely with improvements and spreading their use to the two billion inhabitants of the earth, giving major attention to social improvements. But from the military-industrial mobilization standpoint no such *laissez faire* is possible.

There are those who appear to believe that peace and the elimination of war can be had by charm and incantation, but history is filled with examples of the hopelessness of trying to maintain peace and order without an adequate policing force. In the seventeenth century the Persian Empire, composed of an Indo-European or Aryan people, was a great and rich trading nation. Its capital, Ispahan, was a city of more than a million population with magnificent buildings and fabulous bazaars. It was the gateway of trade between East and West. It wanted nothing more than to be left alone to trade.

But the Afghan Khans, incited to cupidity by its wealth, overran and destroyed it. Ispahan today is only a miserable town. The greed of the world is not found merely with armed barbarian horsemen; those who can attack Western civilization now have full access to all the developed methods and tools of science.

Power for Peace

Political factors in our present world decree that only that nation which keeps an acknowledged superiority in science can hope to have the power and the authority to maintain peace and save our prized Western social system from destruction. Actually, in this scientific age we have built up an economic machine that cannot pause for breath—it must go forward at an ever-increasing pace or it will be destroyed.

There are weaknesses in the rival civilization, chief among which is the fact that a social system built merely on the human-materialistic brotherhood of man as advocated by the Communists, if left alone to operate by itself would eventually destroy itself by its inherent doctrine of survival of the fittest, as already evidenced by the necessity for wholesale liquidations and more recently by the Tito dissension. But we must realize that it is not left to operate in isolation; in devious ways it receives our aid, and it gets the benefit of much of our science.

Far from the Ideal

The true brotherhood of man that is an essential foundation of democracy cannot be bought, bartered, nor imposed on others by idealists; it comes only from mutual trust and honest good will based on a sense of an accountability for right action to an infinite Creator. Unfortunately, the world is far from that ideal condition today, and international peace in our time will be had only by the nations able to maintain it.

Thus, to be practical, we have no choice. We must be preëminently first in scientific industrial mobilization. And we must at the same time make certain that we are the masters of science, not the slaves of a materialistic conception of science that would debase the human mind to a material growth and scorn the developed truths of the mind as merely "opinion."

We must also make certain that by progressively improving our social and economic system we can demonstrate to the world in a practical manner that our philosophy of life can most effectively spread the benefits of science to the masses. And this means, too, that we must realize that the coolie who digs tin gravel in a Malayan stream, or the Indian who mines manganese in South America, is a necessary link in our production system and must be given a just deal.

It is for these basic reasons that any one who studies industrial procurement objectively in its long-range aspects must inevitably come to the conclusion that research, a high degree of flexibility to

Colonel Brady is a business consultant, raw-materials expert, editor, and the author of "Materials Handbook."

adopt new things quickly, and an overall administrative determination to develop foreign materials' resources on an equitable long-term program should be the foundations of any materials' mobilization plan.

During the war the Army released men to work in western mines, but in 1943 it refused more releases because it said that there was much idle labor in foreign producing areas in neutral countries where it was vital to maintain morale by purchasing their production. But I am concerned here more with the effects of the possible new materials of research on our own domestic system rather than the foreign aspects.

Greater Changes Will Occur

When one contemplates the tremendous changes in raw materials in the past century, realizing that changes are now moving at a more rapid rate, he must believe that far greater shifts will occur in the next quarter of a century, which is the time limit that even the optimists concede may bring a showdown between the two opposing civilizations. Viewing the great steel industry of today it is hard to realize that coke was first used commercially in smelting iron only just a century ago, and that it was not until six years later that Bessemer took out his patent for producing steel by blowing air through molten iron, and that it was not until 1851 that Alfred Krupp was able to make a casting as large as two tons.

Less than a decade before, the first vulcanized rubber had been made and the first practical malleable brass invented. And it was not until 1852 that modern chemistry was made possible by the discovery of valency and the closed benzene ring. Until borax was discovered in California in 1856, all borax for glass and soap and chemicals came from Tibet at a cost of $700 a ton —a lot of money in those days.

So it was with aluminum, magnesium, plastics, and a hundred other materials —all unknown commercially a century ago. With these things in mind, the nation that accumulates materials to build equipment for 1965 on the plans of 1945 will be a dead duck!

German science has been outstanding. From Germany we got synthetic rubber, many dyes and drugs, the splitting of fatty oils, the hydrogenation of coals to gasoline, the hard carbide cutting tools, electrolytic tin plate, notable advances

"When one contemplates the tremendous changes in raw materials in the past century, realizing that changes are now moving at a more rapid rate, he must believe that far greater shifts will occur in the next quarter of a century."

in magnesium, sugars and proteins from wood, and innumerable other pioneering achievements. The German has an orderly and mathematical mind well adapted to tackling the problems of science, but this is not the reason for German preëminence.

The mixed population of America has some definite advantages in this respect, and America has never lacked young minds of vision and persistence, nor has America lacked progressive older men with the vision to encourage and finance science. In fact, many outstanding new developments were first visualized in America and in England but had to be taken to Germany to be commercialized. It might only be embarrassing to mention some of these.

Impediment to Progress

The chief impediment to further rapid progress in America is the enormous investment in old plant and equipment not covered by short-term depreciation funds. The chief reasons for the rapid adoption of scientific discoveries in Germany were the driving need for new developments, because of the poverty of German domestic resources, and a different attitude toward plant overhead.

While we, in our extravagance, said that steel could not be made without manganese, the Germans made steel without that material. While we, in our pride, spurred farmers to plant more linseed by paying huge government doles, the Germans made excellent paint oils from paper-mill waste liquors and from the residue benzolated oils derived from scrubbing coke-oven gases. While we prodigally burned millions of tons of huge branches of trees and enormous quantities of sawdust from our lumbering, the Germans devised chemical means to utilize this waste to produce sugars, chemicals, fats, and even good butter for their army.

Any industrial nation that thus has to keep on its toes to provide raw materials will naturally be outstanding in all scientific work because its scientists are encouraged to ever greater efforts by the ready acceptance of their discoveries. And in reverse, any industrial nation that seeks great stocks of old materials as an anchor of future dependence may deaden initiative.

Just 700 years ago, at the beginning of the "modern" mechanical age, Roger Bacon, the man who brought the compass and gunpowder to England and was the father of practical experimental science, pointed out four great causes of error and impediment to progress in science: Undue regard for past authorities, habit, prejudice, and false conceit of knowledge. Those factors are still with us because they are human failings. But they are diseases of age, of the kind that caused Lord Tennyson to write, "Old experience is a fool." They are not afflicting our research in its general advance because our research for the most part is new and young.

Reviewing the development of the atomic bomb, one is struck by the fact that the scientists were mainly young men and that such peering into an unknown future and persistent conquering of baffling obstacles could hardly have been done by minds filled with the cautions of old experiences. The almost unbelievable work done in the synthesizing of proteins was also done by very young men daring to tackle almost visionary dreams. In fact, the whole chemical industry, which has nearly quadrupled since 1939, owes its great technical vigor to the fact that it is a young industry unhampered by precedents.

Advancement Unforeseen

In an age when only a few favored sons of the nobles could get an education in science, Bacon could not have foreseen how we are able to conquer these four natural impediments with our extensive modern laboratories and our vast educational system that can prepare hundreds of thousands of youths for active scientific work early in life.

But let my observations on youth not be misunderstood. The impulsive daring of youth, unhampered by experiences with difficulties, is valuable in the unfolding of the unknown things of science, where mistakes merely mean financial loss. But long experience,

caution, and a gauge of surety are needed in social, economic, and political matters where a mistake can mean ruin to a system.

I believe it was Aristotle who wrote, "He who expects judgment from youth lacks judgment himself." And Francesco Petrarch said, "In great affairs I have always dreaded the counsels of the young. Youthful inexperience has been the ruin of many empires." In the management problems that confront our complicated industrial plant system we probably need an exceptional combination of both young and old minds.

The tax system is too often blamed for causing the condition where old plant cannot be replaced when processes are made obsolete by new discoveries. But the trouble antedates our present corporation tax system, and it is more probable that some present taxes were brought about by accounting abuses. Theoretically, accounting systems always provided that replacement funds be set aside so that equipment and plant could be replaced at the end of its useful life. But how often have revaluations been made and new stock issued against these new revaluations? And how often have boards of directors dampened the ardor of scientists by vetoing the scrapping of old methods as long as they produced profits? And how much of the premium payments, tariff protection, and other government paternalism has been to protect uneconomic methods that should have been scrapped? No small part of American industry today is located in outmoded uneconomic areas and in ancient plant because it cannot afford to discard the old.

It is a well-known fact in government that if an agency can get a large enough appropriation and build up a big enough staff of men interested in perpetuating jobs, it can go on forever tilting at windmills and maintain prestige by its size so that no one will dare question the validity of its operations. Something similar also occurs in industry, though in a quite different manner.

Living on Past Record

An industry that may have had a fine record of progressive achievement during its growing years can become technically backward or even completely obsolete and yet may be able to live on its past record and assume the attitude that any one who dares to criticize it is a radical who wants to destroy our established system. Such an industry may feel itself perfectly justified in maintaining its position because of its huge investment in old plant that will still be profitable as long as new plant with new processes is not established.

Like the parts inspector in a production factory, whom everybody dislikes because he points out the errors and ignores the good, I am conscious that I may be criticized. But like that inspector who is interested only in the good of the whole, I complain of the two per cent that may be wrong so that we may be alert that it does not grow to five or ten per cent. "Truth is grievous," said Cicero, "but complaisance is more grievous because it allows a friend to be precipitated to ruin by yielding to his faults."

Engineers who have had a glimpse of life behind the Iron Curtain tell us of the Russian mania for great power plants and how this power is serving to refine metals alongside the mines where also are located the factories to manufacture the products. Contrast this with the fact that more than half of the cost of pig iron to most American manufacturers is freight!

As far back as the early 1920's Tschitcherin was quoted as having said that Russia's new industry would eventually surpass American industry because the latter could never afford to move out of old areas and replace its outmoded ways.

From the industrial-military mobilization viewpoint, the most strategic shortage material in this country is power, if for practical purposes energy can be considered as a raw material. When the first great coal labor strike hit the country just after the turn of the century, coal furnished ninety per cent of all industrial energy. Today coal furnishes less than fifty per cent. But the balance is largely from petroleum and natural gas, two materials that are in increasing demand for the synthesis of many chemicals. The percentage rise of water power and energy from other sources has been slight compared with the relative increase of these in Russia.

"Any industrial nation that has to keep on its toes to provide raw materials will naturally be outstanding in all scientific work because its scientists are encouraged to ever greater efforts by the ready acceptance of their discoveries."

Russia is reported to have used sixty million tons of peat last year for conversion to power gas and to tar for chemicals. Adjacent to our own Mesabi iron-ore range, and in an area where power is needed for other purposes, are billions of tons of easily available peat. When processed, it is not only a rich source of fuel gas but also of montan wax and an abundance of residue tar containing the C_1 to C_{24} acids from which the Germans made acids, alcohols, plastics, greases, and many chemicals. In the war year 1944 we had to divert petroleum tankers to the carrying of foreign molasses to make industrial alcohol, and that year we used some 330,000,000 gallons of alcohol for the synthetic-rubber program alone. We know how to make alcohol from a superabundance of waste products, but in peacetime we are not handling such matters on the coördinated national basis that we did in wartime.

Furfural from Corncobs

One plant in Iowa is processing 30,000 tons of corncobs annually to produce furfural, a chemical that has big possibilities for making many products, yet the material must be carried off to another area where there is power. The Department of Agriculture points out that we are not using one per cent of the commercial potential of farm wastes, and that nine billion gallons of fuels could be obtained annually from corncobs, peanut shells, and similar products now being wasted.

It has been long known that corn stalks contain up to fourteen per cent sugar. One type of corn developed at the Connecticut Agricultural Station has produced good ears of corn and nearly nine per cent of sucrose—the natural sugar of sugar cane—from the stalk.

Out of the hundreds of materials that affect our mobilization potential I have mentioned only a few, not as exceptional cases but as examples of how scientific research is already far ahead of our ability to utilize the new findings effectively. My only desire is that they will serve to indicate that the economic record of 1945 cannot serve as the basis for the industrial materials procurement of the next "emergency."

U. S. Army

The Rocket Problem

New Developments Promise an Answer To an Inherent Defect—Inaccuracy

by

Col. Leslie A. Skinner

At present, the use of the artillery rocket is restricted principally to that of a barrage weapon

THE Hale and Congreve artillery rockets of many years ago differ little in technical concept from those of today. Sadly enough, in performance they were not as much inferior to today's as we might think. Even though better steels, powders with higher energies, and improved means of manufacture have increased pay load, velocity, and range, the same inherent defect that prevents artillery rockets from assuming any except the barrage rôle of artillery is still with us—poor accuracy.

The initial months of World War II saw an attack on this problem in the United States, first in the form of a finned projectile using a rather fast-burning propellant, then one using slow-burning powder, followed closely by spin-stabilized rockets, some with fast and some with slow propellant.

The net result of all this was 11 to 12 mils probable error for the best of the finned, and 8 to 10 mils error for the best of the spin-stabilized rockets—better certainly than any predecessors but still far from gun or howitzer accuracy with their deflection probable errors of 2 mils or less. Assuming this large degree of dispersion is still the case with artillery rockets—and we can make a fair guess that it is—why is it so and what might be done about it?

Several worthy mathematical reports give reasonable answers why, much of which boils down to the fact that so far we have not been successful in keeping the axis of rocket thrust on the geometric longitudinal axis of the projectile as closely as we should for the accuracy wanted. Other errors do exist, of course, but, excepting the effect of wind on the fins of a rocket during burning, these are the same as those affecting the conventional artillery shell.

Fabrication No Problem

It would seem that with available methods of manufacture which can produce items that vary one from another in only fractions of a thousandth of an inch, keeping the longitudinal axis of the rocket and the nozzle axis essentially coincident should not be too difficult a fabrication problem. Therefore, if this were the complete answer it might be solved in spite of the solid-propellant rocket motor being a thin-walled vessel subject to a rather sudden application of high pressure and temperature as well as to various acceleration forces.

Unfortunately the perfect alignment of these two axes does not necessarily mean that the thrust axis will also jibe up. Causes of gas-flow deviation from the expected path do exist for reasons not too well understood—possibly unequal temperature distribution—resulting as surely in a component of thrust athwart the long axis as would a canted nozzle.

It is indicated that these unpredictable and troublesome forces exist also in liquid-fueled rockets. That these forces are accentuated in solid-propellant rockets, especially where more or less bulky and elaborate traps are used to hold the powder and where the mass of the powder itself may cause nonsymmetrical flow, is very strongly

supported by available measured results.

One of the attacks on this cause of inaccuracy was to give the finned rocket a spin about its longitudinal axis from very few to several hundred revolutions a minute in various laboratory field tests to see if this would not "iron out" the effects of errant thrust. To a very small extent it appeared to help but not enough to make any decided improvement.

Another attempt was to stabilize the rocket fully by spin, hoping in spite of all the other difficulties introduced by this method to improve accuracy to the point where it would fully justify these complications. It can hardly be said that these hopes were justified, although the improvement was enough to cause the spin-stabilized rocket practically to displace the fin-stabilized projectile.

Though yet incapable of being a point-target weapon, the spin-stabilized rocket is the best solution five years after the first experiments were tried. This apparent halting of progress does bring up the question of how hopeful we can be of really solving the accuracy problem by spin stabilization alone for artillery rockets.

Major Difficulties

To have some basis for estimating, perhaps an outline of some of the difficulties facing us would help. The major ones are as follows:

1. The resultant line of thrust of all the canted nozzles or vanes used to give spin to a rocket by deflecting the jet must pass through, or very close to, the center of gravity of the whole projectile.

2. The rocket motor as well as the head of the projectile must be essentially round.

3. The inner and outer surfaces of the thin-walled motor must be concentric within small limits—a feature of some importance at a spin of 18,000 revolutions a minute or better.

4. The head, motor, and nozzle plate when assembled—and this usually means two threaded joints—must result in a straight projectile.

5. Assuming these favorable conditions all exist at rest, they must continue to exist when the internal pressure suddenly (and not necessarily always evenly) rises to several thousand pounds per square inch; when the motor-wall temperature may go (and again not necessarily evenly) above the annealing temperature of the metal; and when the forces due to the spin become greatest at the time when part of the motor is the hottest and weakest and while pressure is still relatively high.

6. In addition to these conditions there must be no unsymmetrical clogging of orifices by pieces of propellant or any material such as igniter fragments, restricting material, or wall insulation, and no unequal erosion of the multiple nozzles or vanes.

Col. L. A. Skinner holds important place among modern American rocketeers. He served for many years in the Ordnance Department of the Army where his individual researches—often conducted under difficult conditions—paved the way for phenomenal advancements in the field of rocket design and application. In the second World War, American rockets soon became weapons of far-reaching importance. Their place in the future of battle operations is clearly indicated to be on a par with the other newer forms of ordnance. That this is so is largely due to the ability and perseverance of Colonel Skinner who followed his convictions and led the advance to new horizons in American rocketry.
—THE EDITORS.

The finned artillery rocket, while not subject to trouble arising from spin, has plenty of its own. Fin or spin, the dispersion factor is there and will likely remain for some time unless we can design a rocket in which the *burning time is less than the time it takes the rocket to move the length of its launcher;* in which no propulsion of the rocket takes place beyond the end of the launcher.

If this condition exists and the launcher is reasonably well made (which does not require by any means the close tolerances necessary in a cannon) then these off-axis forces are resisted by the launcher and the unguided flight of the rocket is affected only by those forces which work on any conventional projectile of similar characteristics in free flight. In support of this idea, two series of tests, witnessed by the author during the war, gave results approximately as cited below:

A bazooka round, equipped with adequate fins and fired from a launcher in a fixed rest at normal temperature (all burning finished before round left launcher), gave a probable error close to 2 mils, considerably less in some groups. The old crude 4½-inch, fin-stabilized M8 rocket fired from launchers 10 to 20 feet long had a probable error in deflection of 16 to 20 mils. The same lots fired from a launcher 80 feet long gave 4 mils or less.

One may well wonder why these more or less self-evident facts should be raked up. Solid-propellant rocket designers well know the difficulty of making the propellent charge of a rocket a reasonable part of the total weight so as to give adequate velocity and range, even when the powder geometry is such as to utilize the chamber volume to the utmost. With the solid propellants available they know that high pressures and thin webs are essential to very short burning times and that such techniques are accompanied by severe problems of large surface area, securing adequate free port area, trapping, temperature range, and enough weight of powder to give sufficient velocity.

So far the best balancing of these factors has not given results good enough to tempt designers to try to apply very fast burning propellants to rockets except in the case of the bazooka. Even here the essential accuracy is paid for by sacrificing velocity to the point where hitting a moving target is as much luck as skill at more than a hundred yards or so.

Liquid Fuel

If the possibility of attaining gunlike accuracy by means of spin or finned solid-propellant artillery rockets of adequate range and velocity appears doubtful at the moment, then it behooves us to take a good look at another approach to the problem—liquid fuel for rockets.

There is evidence to indicate that the very fast burning of liquid propellants can be used in rocket engines for those purposes where high accelerations can be tolerated and that a greater over-all impulse can be obtained from liquid fuel with a given volume of rocket motor than is possible with solid propellants, especially where diameter is small and high pressures readily accommodated. This may be possible to the extent that full burning can be completed during the rocket travel on a comparatively short and light launcher.

Could it be that we are not giving adequate attention to this possible solution of a vital problem?

Champion of Industrial Security

A Tribute to Secretary of Defense Louis Johnson

by

James L. Walsh

President, American Ordnance Association

"We are here to demonstrate our continuing support of the Honorable Louis Johnson, now head of the Department of Defense, in his endeavors to avert a possible Third World War by a sound program for 'Peace through strength—ashore, aloft, and afloat'"

ON this historic occasion our thoughts go back inevitably to the modest beginnings of a movement which has increased in value to our country with each succeeding year.

Even after the lapse of thirty-two years, some of us retain a vivid recollection of the difficulties faced and surmounted by Maj. Gen. William Crozier, the father of modern ordnance, when "war was thrust upon the United States"—in the words of the Joint Resolution of Congress of April 6, 1917.

On that fateful day the Ordnance Department of the United States Army consisted of 97 officers—when 12,000 were needed. It was against the law to hire additional clerks within the District of Columbia; it was forbidden to lease additional office space or erect a needed office building without specific authorization from Congress.

Immediately upon the declaration of war, estimates for the money required to arm our millions were submitted to Congress—but not a penny was appropriated until June 15, 1917.

We lost sixty-seven days in needless debate to secure funds to carry on the war. We paid for it in the 47 days' Battle of the Meuse-Argonne with 120,000 American casualties.

The original objective of the Ordnance Association was to shorten the duration of any possible future conflict by doing ahead of time everything that could be done ahead of time. We learned to our sorrow that Congress could appropriate billions of dollars—but Congress could not appropriate a single second of time.

A Critical Hour

Thirty-one years ago tonight, General John J. Pershing was on the eve of assuming command of the Meuse-Argonne sector preparatory to starting the great offensive campaign which he hoped would win the war before winter set in. Flushed with success at reducing the St.-Mihiel salient, the American First Army was poised to go over the top in the grim gray dawn of September 26, 1918.

In Cronkhite's 80th Division of Bullard's III Corps was a young combat captain of Infantry from West Virginia. Before nightfall his division had carried two of the enemy's prepared positions, cleared out the Bois Juré, stormed Hill 262, and captured the Bois de la Coté Lemont.

For a week all went well with the offensive, and then, all along the line, the attack bogged down to such an extent that General Pershing in desperation cabled Washington on October 3, 1918: "Unless supplies are furnished when and as called for our armies will cease to operate."

With victory and the end of the war almost within our grasp, failure of our system of supply meant another winter in the trenches. But somehow, by superhuman efforts the necessary supplies were rushed forward, the offensive was regained, the enemy routed. Victory and the Armistice followed five weeks later.

Apparently the young combat officer never forgot the lesson of that grueling experience. As a participant in the founding of the American Legion, he urged that proper attention be paid to industrial preparedness as the foundation upon which to build our entire structure for national defense.

Eventually he was appointed the Assistant Secretary of War, in which position he could effectively implement his ideas. As a matter of fact, the National Defense Act, as amended, made the Assistant Secretary of War responsible for the mobilization of industry not only in support of the Army, including the Air Corps, but also of the Navy, including the Marine Corps. Here he showed a sure instinct for unification by extending to his opposite number in the Navy an opportunity to participate on an equal basis in the program for mobilizing industry.

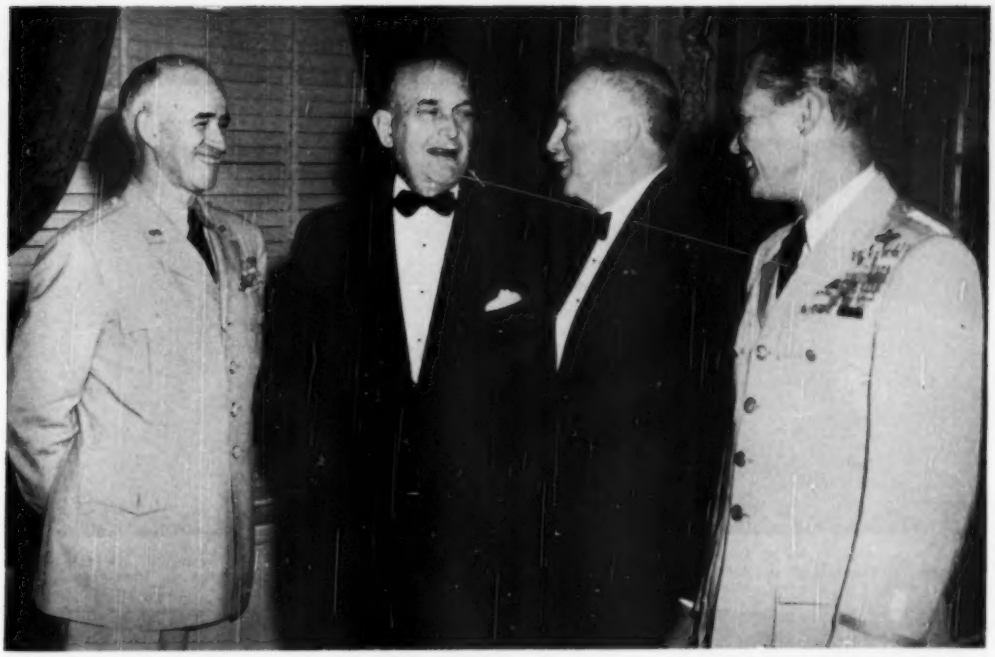
It took courage to come out for industrial mobilization in 1937. The activities of the Nye Committee had succeeded in building up well-organized opposition toward anything like a reasonable degree of industrial preparedness. As the Honorable Cordell Hull, Secretary of State, wrote in his memoirs: "It is doubtful that any Congressional committee has ever had a more unfortunate effect on our foreign relations."

Undismayed by public apathy and even outright hostility, the Assistant Secretary made some two hundred speeches, urging a sound program for industrial mobilization.

What our Assistant Secretary must have had most prominently in mind was the needless casualties of the Meuse-Argonne offensive. We can eventually complete payments on the ultimate dollar-cost of war. We can never replace the brave young lives "killed in action"—the real cost of unpreparedness.

So he bent his energies toward per-

Colonel Walsh delivered these remarks in introducing Secretary of Defense Louis Johnson to the 1,600 members and guests of the American Ordnance Association who had gathered to honor him at a dinner-meeting at the Hotel Astor, New York City, on September 21, 1949. Secretary Johnson's speech is published on page 162 of this issue. A pictorial presentation of the meeting appears on pages 188 and 189 and a detailed account is published on page 194.



Secretary of Defense Louis Johnson (second from left) confers with Gen. Omar N. Bradley, Chairman of the Joint Chiefs of Staff (left); James L. Walsh, president of the American Ordnance Association; and Gen. Hoyt S. Vandenberg, Chief of Staff, U. S. Air Force (right), at A.O.A. dinner-meeting honoring Secretary Johnson in New York City on September 21st.

fecting a practical "mobilization plan" whereby American science, engineering, and industry could swing into action promptly and effectively in the event that war should again be "thrust upon the United States."

He was trying to save time, the most precious of all commodities. For, in war, when we save time we save lives.

During the Second World War we lost 313,000 fine young Americans "killed in action." And that is exactly 313,000 too many!

If the Assistant Secretary's advice had been heeded in 1937 and 1938 and the United States had been adequately prepared, the consensus is that Hitler and the Japanese war lords would never have gone on the rampage which we know as the Second World War. The United States would never have been under the necessity of incurring initial expenditures of some $350,000,000,000 —and the tragically needless cost of those 313,000 gallant young Americans.

His efforts were not in vain. In spite of the enemy's numerical superiority in every theater of combat, our losses in killed were only 20 per cent of the enemy's frightful total of 1,592,000. Logistical superiority in firepower and mobility made the difference. As General Eisenhower has said: "We were able to use machines and technology to save lives."

Aims To Avert War

With this statistically conclusive confirmation of the paramount importance of industrial preparedness, particularly in the noncommercial field of ordnance manufacture, the Association raised its sights and took as its objective not merely the shortening of war—but the reduction of our battle-death expectancy to zero by averting war altogether.

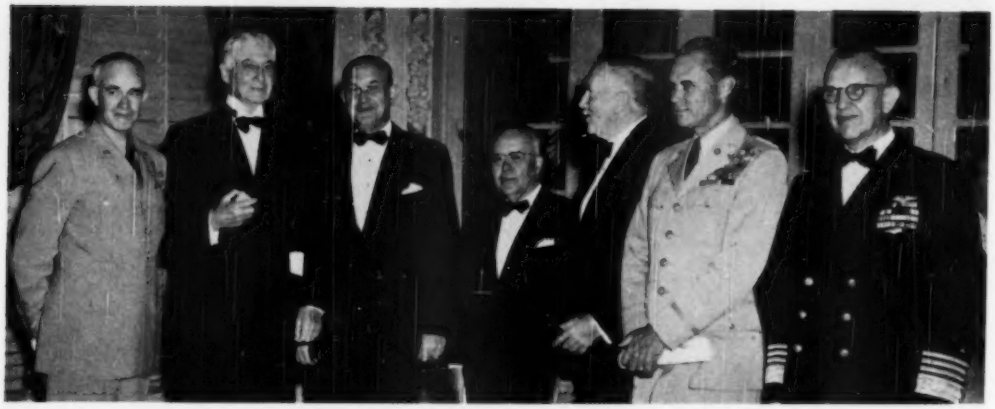
Thus we come to the real reason why we have assembled here tonight. We are here to acclaim that same combat officer of the First World War who knows the value of human lives and abhors their needless waste. We are here to honor the effective advocate of that industrial preparedness which shortened the Second World War—and cut down our battle-death expectancy by eighty per cent. And, finally, we are here to demonstrate our complete confidence in and continuing support of that same person, the Honorable Louis Johnson, now head of the Department of Defense, in his endeavors to avert a possible Third World War by a sound program for "Peace through strength—ashore, aloft, and afloat."

Ten years ago the great body of the public failed to heed his advice—and paid the penalty in hundreds of billions of dollars and thousands of lives.

Just six months ago, speaking in this very room, the late James V. Forrestal, first Secretary of Defense, referred to his successor in these terms: "His record of foresight in the preparation of the Nation for the war that faced us in 1941 is an evidence of his capacity and ability to discharge his duties well. I bespeak for him your hearty confidence, your complete support, because I can assure you he will embark on one of the most complex and difficult tasks in the country."

We will be wise to listen receptively this evening. Our guest of honor knows what he is talking about. He is still seeking to save lives—this time perhaps our own lives.

THE ORDNANCE FRATERNITY

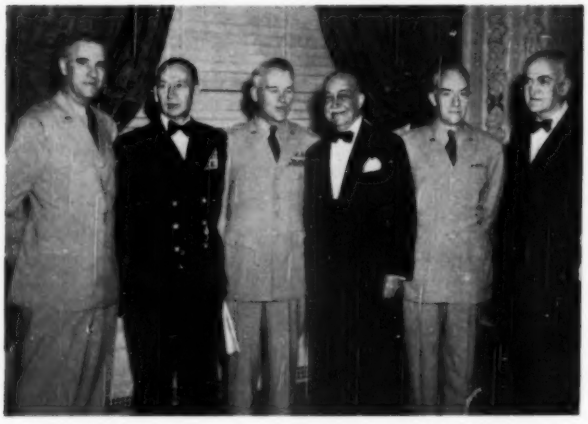


Left to right: Gen. Omar N. Bradley, Bernard M. Baruch, Secretary Louis Johnson, John G. Phillips, Pres. James L. Walsh, Gen. Hoyt S. Vandenberg, and Adm. Louis E. Denfeld foregather in the Rose Room of the Hotel Astor on September 21, 1949.

Maj. Gen. Everett S. Hughes and the Rev. Dr. Charles Trexler chat during dinner.

Left to right: Thomas J. Watson, Gen. Omar N. Bradley, Charles E. Wilson, and Hon. Francis P. Matthews were honored guests at the meeting.

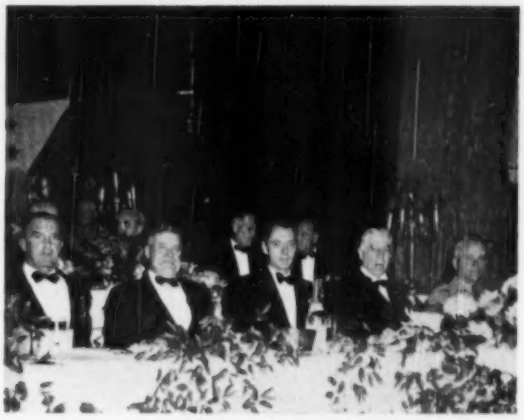
Maj. Gen. R. C. Coupland and Maj. Gen. B. E. Moore join in the festivities.



Left to right: Maj. Gen. E. L. Ford, Rear Adm. A. G. Noble, Gen. J. L. Collins, C. S. Comeaux, Lieut. Gen. LeRoy Lutes, and Maj. Gen. J. H. Burns.

HONORS SECRETARY JOHNSON

Gen. C. B. Cates, U.S.M.C., and J. L. Auer exchange pleasantries at dinner.



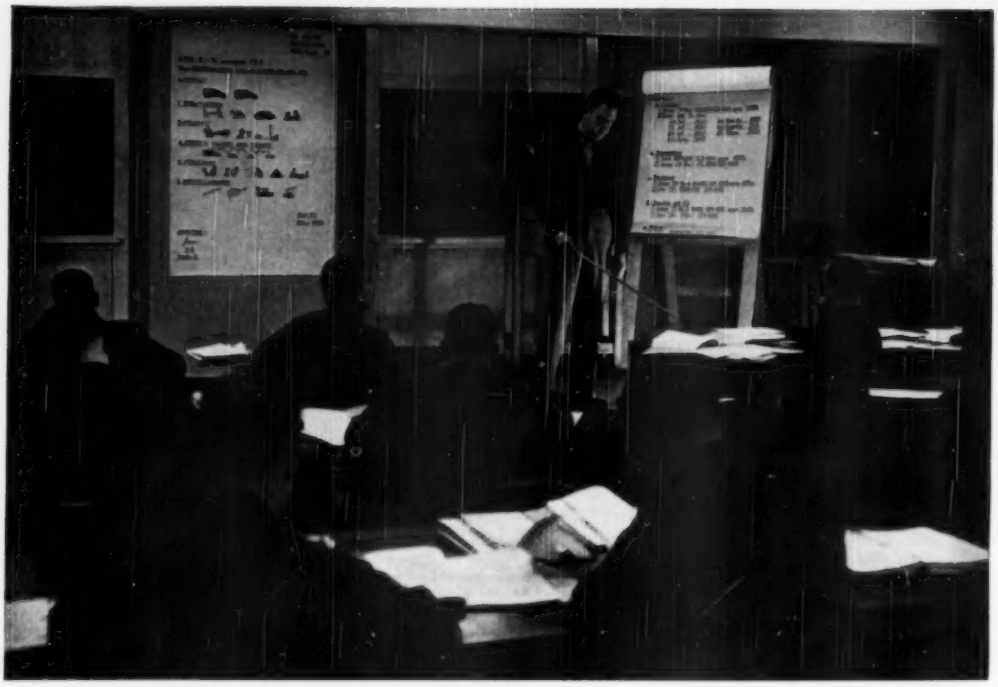
Distinguished guests were, left to right, Hon. W. S. Symington, K. T. Keller, Hon. A. S. Alexander, Mr. Baruch, and General Collins.

Enjoying a hearty laugh at dinner are C. Jared Ingersoll and Adm. W. H. P. Blandy.

Left to right: Maj. Gen. J. H. Burns, Rear Adm. W. S. DeLany, R. L. Biggers, and J. M. Olin, civilian and military leaders.

Left to right: John Slezak, Rear Adm. A. G. Noble, and Hon. Frederick H. Payne.

Left to right: Herbert A. Gidney, Secretary Louis Johnson, and President James L. Walsh exemplify industry-military unity.



Industrial College Goes Afield

A Course in Economic Mobilization for Civilians

by

Col. T. F. McCarthy

The basis of preparedness is adequate planning between the military and civilian elements

THE echoes of the atomic-bomb blasts at Hiroshima and Nagasaki had scarcely died away when the head people at the Army Industrial College went into a protracted huddle. Their task was to reactivate the college and soundly plan its functioning for many years in the future.

Their first and pressing problem was to line up an interim course in economic mobilization which would lay a firm foundation for the full 10-month courses to be given during the following years. They also realized the necessity for gleaning all available knowledge from officers who had taken active parts in the logistical effort of the recent "unpleasantness." To judge by the success of those plans made in the early days after the fighting ended, the planners earned themselves figurative leis of orchids.

When the Industrial College of the Armed Forces—the name was adopted in 1946 to emphasize the all-service character of the school—was rolling along in high gear in 1948, the commandant was faced with another problem. The matter of Reserve instruction loomed larger and larger on the educational horizon. Brig. Gen. E. B. McKinley, then commandant, saw that not more than a relative handful of officers were receiving instruction in economic mobilization each year. At this rate it would be many, many years before any appreciable number of officers of the armed forces would be thoroughly indoctrinated and educated in that most important field. In case of a war within the next decade the graduates of the Industrial College would again have to be spread mighty thin—too thin for comfort.

General McKinley went into a long conference with himself and then—to mix the metaphor thoroughly—laid the Field Economic Mobilization Course problem in my lap. The commandant's original concept has proved remarkably sound in all its basic elements. The plans, as originally drawn up and presented to the Secretaries of Navy

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and War, provided for a 2-week course to be given throughout the country to Reserve officers of the Army, Navy, and Air Force, and to junior executives of industry.

The Secretaries approved the proposals in principle and directed further that the category of those invited to attend be broadened. Thus the groups to be offered the instruction finally included, in addition to the Reserve officers of the three services, National Guard officers, industrialists, educators, and other prominent civilians.

With the blessing of the top military people on our project, the next step was to plan the course. This came down to a matter of judgment in selection. Fundamentally, the field course was to be a "reader's digest" version of the full 10-month course. The wealth of material available was staggering. The problem was to select subjects of interest, of value, and of purpose and to present them as an harmonious whole.

The selection of faculty officers for the instructional team was not simple. The qualifications were exacting. Each officer had to volunteer, he had to have ability as a platform speaker as well as an instructor, and he had to face financial loss (at seven dollars per diem) as well as absence from his family at least half the time. In other words, he had to be a zealot in the cause of economic mobilization or he never would volunteer.

The team was composed of six officers: two Air Force, two Navy, two Army. It is difficult to realize what a great impression a team made up of Army, Navy, and Air Force officers make on civilians in the field. You may rest assured that we have not been slow to point out this practical demonstration of unification at work.

While the rest of the officers of the instructional team were preparing their lectures, two members of the team went to New Orleans and Birmingham as an advance party. They realized that they were pioneers, and they felt their way along very cautiously.

Col. George E. Keeler, Jr., of the Air Force, in charge of the advance party, handled things so capably that the pattern he evolved has been followed ever since, with only minor modifications.

Our standard operating procedure is to arrange by mail, before leaving Washington, for an organizational meeting. In attendance at this meeting are representatives of the senior military commanders in the area, public information officers of the three services, and a few leading citizens of the community who have demonstrated their friendship for the military on many occasions.

If Armed Service Advisory Committees have been appointed in the particular city we wish to visit, we lean on them very heavily. In New Orleans, Colonel Keeler found that an Army Advisory Committee had been appointed but had been given no special tasks up to that time. They leaped at this initial opportunity to be of some real service to the military.

At the first organizational meeting the advance officers explain the project, answer all questions, and diplomatically suggest action in forming the usual committees.

The committee organization is simple. The first committee, one on arrangements, is made up of civilians and military. The military members are charged with all the administrative matters necessary to active military personnel who attend the course. These services may include such matters as physical examination, travel orders and vouchers, pay, billeting, bus transportation, and messing. The civilian members of the committee arrange for hotel reservations, lunching facilities, parking spaces, and an auditorium. There are numerous other arrangements to be made along those general lines, differing according to the special circumstances in each city.

The civilian selection committee, which some prefer to call the civilian admission committee, is composed wholly of civilians. Their duty is to canvass the whole area and select a cross section of leaders in industry, education, labor, science, and civic affairs to attend the course. When the committee's list is complete they send it to the commandant of the Industrial College who extends an invitation to each person selected to attend the course.

A third committee deals with publicity. From the start we have taken the position that we do not seek publicity. We feel that the impression made on the people taking the course is producing the lasting results we desire. If any newspaper, magazine, or radio station, however, feels that any of our activities are newsworthy, we cooperate one hundred per cent.

In 1948 *The New York Times* believed the course was so worth while that it assigned a special writer to attend and cover the complete curriculum. *The Times* devoted at least a full column a day to the story of economic mobilization as presented by the faculty instructional team. In nearly every city, one or more of the officer instructors takes part in a radio program. In the last few months we have also appeared on television programs two or three times.

A steering committee is appointed but seldom is called upon to function. It is composed of the chairmen of the other three committees. In case any of the three other committees seem to be "dragging their feet," the steering committee goes into action.

First Series Successful

The first series of courses, January through June 1948, was so successful that the commandant of the college, Maj. Gen. A. W. Vanaman, directed the formation of two teams for the academic year 1948-1949. These two teams, named Blue and Gray, have completed the second series. The third series is now under way and is being handled by the two teams, still Blue and Gray. The composition of the teams changes from time to time due to normal attrition, but the makeup is adhered to religiously—two Air Force, two Navy, and two Army officers on each team.

This strict adherence to the all-service character of each team has been slightly modified to the extent of assigning a Marine officer to one of the Navy rôles. This is in keeping with Industrial College tradition. Marines fill a proportionate part of the Navy quota on the

Between January 1948 and May 1949, over 2,100 civilians and over 2,600 senior civilian-component officers completed the field course in economic mobilization.

faculty of the Industrial College, in the student body, and in the student body of the Field Economic Mobilization Courses.

The first series was presented in New Orleans, Birmingham, San Francisco, New York, Pittsburgh, and Chicago. The second series, in the 1948-1949 academic year, was presented again in New York, Chicago, and Pittsburgh, but the other presentations were in smaller industrial areas such as Seattle, Houston, Atlanta, and Denver. Until this type of schedule appears unsound, it is planned to follow the pattern of repeating the courses in the larger cities each year and in the smaller cities every two or three years.

In each city where the course is presented, the Army, Navy, and Air Force furnish, when available, officers and enlisted personnel to carry on the local administrative duties. The faculty have their time pretty well filled up with instructional and incidental duties.

Each team has its own organization: chief, administrative officer, public information officer, supply officer. Experience has shown that each one of these officers has plenty to do in addition to delivering his share of the lectures.

When General McKinley originally conceived the idea, and would discuss it in a thinking-aloud manner, he would often say, "A complete course in a brief case." Since it is a lecture course, the lectures may be carried in a brief case, but the visual aids and handouts for each team weigh hundreds of pounds. The equipment of each team includes one chart-and-map box, ten feet long and eighteen inches square; five foot-locker-sized boxes; and a show-card box, five feet square and ten inches thick.

We are sometimes questioned on our nonuse of movies. Every minute of our scheduled course time is precious, and we have yet to see any films which would fit into our program and warrant the expenditure of the required time. One Reserve officer in New Orleans remarked that he was glad he didn't have to look at training films and that nothing would kill the course quicker for most Reserve officers than to show some poor or inappropriate films.

Following the pattern of the Industrial College in Washington, field trips have been scheduled occasionally. These are fine, if they are worth while. But it is not nearly as easy to arrange for a profitable field trip as one might think. There are four hours of instruction a day, usually set by the arrangements committee at 10 A.M. to 12 noon, and from 1:30 P.M. to 3:30 P.M. It is difficult if not impossible to travel a few miles and see any industrial operation after 3:30 P.M. With a 5-day week, there is little industrial activity on Saturdays.

At Pittsburgh, one day in 1948, very special arrangements were made. The four scheduled lectures were presented in the forenoon, and after lunch everybody went out to the U. S. Bureau of Mines Synthetic Fuel Laboratory at Bruceton. That was well worth the effort, but four lectures in a row is ordinarily too much at one time, especially when one considers the usual seats. It seems the mind will absorb only as long as the seat endures!

Questions Invited

Each lecture period is scheduled for fifty-five minutes. The lecturing officer usually times his presentation at something between forty-five and fifty minutes, thus leaving a few minutes for questions and discussion. It was found at first that there were many questions left unanswered due to lack of time. Accordingly, the schedule was revised to insert three regular question and discussion periods of fifty-five minutes each. In addition, a form is furnished, and questioners are requested to turn in written queries the day before the question period.

The evening before this period the faculty officer who is to handle the session holds a faculty conference and distributes the written questions to the officers in whose fields the answers lie. This has been known to send an officer to a reference library bright and early the next morning, and on a few occasions recourse was had to Washington for the answer. In New York, I visited the British Information Service in Rockefeller Center for answers to a couple of my questions.

On the first day of the course the team administrative officer nominates a social committee from the civilians and civilian-component officers in attendance. You may note that I am reluctant to call them students. Practically every newspaper article on the course puts the term "student" in quotes, a form of press satire, I suppose. Hence my reluctance to use the term. The term "conference" does not apply, so those in attendance are not called conferees.

However, suggestions are made to the social committee that a "mixer" party would help to get the people acquainted and break down formalities. Some social committes are so energetic and go into action so promptly that they have the first party on Tuesday of the first week. Usually there is a buffet or dinner party the second week. These social affairs pay off in comradely dividends out of all proportion to the moderate expenditure of time and money.

We have a questionnaire form which all who attend are requested to fill out and turn in at the termination of the course, signed or unsigned. We ask for constructive criticism. Most of the questionnaires are so highly complimentary that but for our native modesty our heads might be turned! The constructive comments furnished on the questionnaires are of great benefit in modifying and revising the course.

In one large city, deans of two universities attended. One praised the course highly; the other wrote three pages of caustic criticism. We gave this caustic criticism serious study and thought, but found very little material therein which could be used to improve the course. Many men, many minds.

Where do we go from here? If the response to the course throughout the country, from Seattle to Atlanta, from Boston to Los Angeles, continues to hold up, it demonstrates unquestionably that we are steadily advancing the cause of national security by making many people economic-mobilization conscious.

Between January 1948 and May 1949, over 2,100 civilians, mostly key men in their own fields of activity, and over 2,600 senior civilian-component officers, many of them, too, key men in civilian pursuits, completed the course.

Certainly if World War III should come upon us within the next decade, our alumni will be better able to carry out their assigned tasks, in mufti or in uniform, for having given some time, study, and thought to that foundation stone of national security—economic mobilization.

Month by Month: A Review of the National Defense Situation

STRENGTH OF THE ARMED FORCES

Under Secretary of the Navy Dan A. Kimball recently disclosed some interesting facts and figures about the strength of the military services and of the Navy in particular. For example, on August 1, 1949, there were 1,592,800 men and women wearing the uniforms of the military services. Some 815,000 civilians were required in support of the Defense Establishment. Even with the reduction of 150,000 civilians and military personnel as a result of the recent economy drive and attrition, we still have a million and a half men and women in uniform and over 600,000 civilians in the National Military Establishment.

The United States Army operates 209 major installations within the continental limits and several hundred installations overseas. The Air Force maintains 108 air bases and industrial activities in the United States and some 63 Air Force installations overseas.

The Navy also is a tremendous and complex organization. Today 515,000 Americans wear its uniform and 300,000 civilians are employed in support of its activities. The active fleet of the Navy today includes 272 combat ships while the reserve fleet is made up of 658 combat vessels. Amphibious vessels, combat ships, mine craft, auxiliaries, patrol craft, and training ships of the active and reserve fleets, plus those assigned to the Naval Reserve training program, total 2,605 vessels of types ranging from a few feet in length to over 1,000 feet at the water line. Today's Navy operates a total of 10,920 airplanes, of which 7,460 are combat aircraft. Today's Navy requires a total of 2,500,000 separate items of material carried at a book value of $9,705,989,000.

DISPERSAL OF INDUSTRY

Air Force Secretary W. Stuart Symington recently began a series of conferences with West Coast air industry executives in an effort to get aircraft factories moved inland, away from potential coastal target zones.

First among the manufacturers on Mr. Symington's list was the Boeing Aircraft Company at Seattle, Wash., builders of the wartime B-17 and B-29 airplanes, the postwar B-50, and the heavy jet bomber, the B-47. Other manufacturers concerned include Northrop, Consolidated-Vultee, North American, Hughes Aircraft, Lockheed, Douglas, and others—all located within a few miles of the Pacific ocean.

The Air Force believes that the entire aircraft industry should be moved inland; that each manufacturer should disperse the manufacture of military aircraft throughout the Middle West where bombing or shelling by a potential enemy could be held to a minimum. For example, the Air Force believes that the primary factor, should war come, is not the danger of attack by long-range bombers but, more probably, the prospect of carrier-borne enemy aircraft attacks that could easily strike inland at a radius of 200 to 300 miles in coastal areas. Submarines can also be equipped to carry aircraft or guided missiles.

Most important, however, the Air Force feels that concentration of eighty per cent of this Nation's vital aircraft industries should not be located within "atom-bomb range" of each other. To bolster this argument, Mr. Symington has had a chart prepared of the Los Angeles area which illustrates how six atom bomb bursts in that single area could wipe out Lockheed, Consolidated-Vultee, and Douglas—all of which are prime contractors for military aircraft.

Boeing Aircraft, with the contract for the B-47 jet bomber, also has a major assembly plant at Wichita, Kans. While component parts of the B-47 are made at the Wichita plant, assembly of the jet bomber and the major concentration of B-47 employees are at Seattle. This situation, the Air Force believes, should be reversed.

While Boeing Aircraft officials state, according to *Armed Force*, that they are not personally opposed to Mr. Symington's effort to transfer manufacture from Seattle to Wichita, Seattle business interests obviously are concerned in retaining the Boeing establishment.

For example, Boeing officials state that the Boeing plant is one of the major industries in that city. Its pay roll runs into millions of dollars annually. Additionally, Boeing claims the problem of convincing skilled employees to move from Seattle to Wichita in itself would be a herculean task. Further, the Wichita plant of Boeing is considerably smaller than the Seattle plant, which would necessitate a factory building program for which the Air Force has not devised a solution.

The Chance-Vought Company, subsidiary of United Aircraft, Inc., has already moved to Texas.

ORDNANCE has long been aware of the necessity for all major industry to analyze the problem of plant dispersal for greater national security. An article by Robert Wood Johnson, entitled "Dig, Son, Dig," in the January-February 1947 issue discussed the possibilities of underground factories. Gayle W. Arnold, author of "Disperse for Survival" in the September-October 1949 issue, advocated dispersal of new plants and facilities as the surest means of combating the atomic bomb.

GENERAL DEVERS REPORTS

The Army is weighing the possibility of using the atomic bomb for tactical purposes according to a report submitted to the Army Chief of Staff by Gen. Jacob L. Devers, as retiring Chief of Army Field Forces, in which he recommended study and test of the bomb for such use.

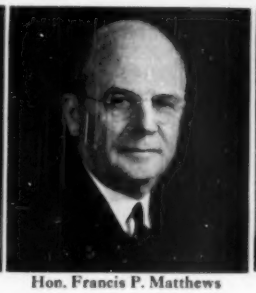
Air transportability also came in for a major share of General Devers' attention in his request that the Air Force be induced "to bring troop-carrier strength to a figure more in consonance with airborne requirements." In addition to suggesting continuing efforts to reduce the weight and bulk of the equipment of the infantry division, he asked for study of the logistical support for a 4-division corps airhead "to resolve the controversial question of the possibility of large airborne operations."

New weapons and equipment are revealed for the first time in the report. They include a full-tracked, completely armored personnel carrier, trucks designed for cross-country travel, vehicular-launched assault-type bridges, and a lightweight rifle which is being developed to replace the present rifle, carbine, and submachine gun.

Association Affairs

Hon. Louis Johnson

Hon. Archibald S. Alexander



Hon. Francis P. Matthews

Hon. W. Stuart Symington

THE HIGH LIGHT OF THE HISTORIC MEETING of the American Ordnance Association at the Hotel Astor in New York City on September 21, 1949, was the address of the guest of honor, the Honorable Louis Johnson, Secretary of Defense of the United States. It is published in full on page 162 of this issue of ORDNANCE. The address was broadcast from coast to coast over the network facilities of the Mutual Broadcasting System. For the first time in A.O.A. history television also was used in bringing Colonel Johnson and his address into the homes of his fellow Americans over the television network facilities of the Columbia Broadcasting System.

Sixteen hundred and three members and guests of the Association attended the function in tribute to the Secretary of Defense. Never before in the history of our Association was there a more brilliant gathering of distinguished military and industrial leaders in attendance. The Secretary was introduced by James L. Walsh, president of the Association. The invocation was given by the Reverend Doctor Charles Trexler, student pastor, Muhlenberg College. The presiding officer was C. Stewart Comeaux, president of the Association's New York Post. In opening the meeting, Major Comeaux said:

"We are gathered together here at the 1949 Annual Dinner-Meeting of the American Ordnance Association. Similar meetings are held periodically in other cities, in each case under the auspices of the local Post of the national Association. Therefore, as president of the New York Post, it gives me great pleasure to bid you welcome.

"Tonight we have broken all records for attendance. I am informed that reservations have been made for more than sixteen hundred—a truly great tribute to the work of our Association, and particularly to our speaker of the evening.

"And in that connection, may I tritely remark that times do change. This is a return engagement for the Secretary. He visited us here in New York some years ago as the Assistant Secretary of War, when we packed in four hundred persons!

"I would also be remiss if I did not publicly acknowledge the splendid cooperation of our several working committees. Thomas J. Watson's New York Committee has been extremely coöperative. The Dinner Committee, under the direction of Joseph L. Auer, is to be especially thanked for its efforts prior to the dinner and immediately preceding tonight.

"I am now pleased to present James L. Walsh, the president of the American Ordnance Association, who, in turn, will introduce our distinguished speaker. Colonel Walsh was one of the founders of the then Army Ordnance Association, organized in 1919. Retired from the United States Army with the rank of colonel, he had an honorable and distinguished military career. His Association record is also worthy of comment—he has never missed a meeting of the Association's board of directors during the thirty-one years of its existence." (Colonel Walsh's remarks are published on page 186 of this issue.)

In order that the record may be complete it would be well to cite here in full the names of the distinguished guests who were seated at the dais and of the several committees of the New York Post which were in charge of the meeting and its arrangements. Seated at the dais were:

Maj. Gen. Bryant E. Moore, Superintendent, United States Military Academy;

John Slezak, director, American Ordnance Association;

Gen. Omar N. Bradley

Gen. J. Lawton Collins

Adm. Louis E. Denfeld

Gen. Hoyt S. Vandenberg

Rear Adm. Albert G. Noble, Chief, Bureau of Ordnance, United States Navy;

Hon. Frederick H. Payne, director, American Ordnance Association;

Lieut. Gen. Walter Bedell Smith, Commanding General, Second Army;

John Ross Delafield, counsel, American Ordnance Association;

Charles D. Wiman, director, American Ordnance Association;

Gen. Hoyt S. Vandenberg, Chief of Staff, United States Air Force;

Henry P. Erwin, treasurer, American Ordnance Association;

Adm. Louis E. Denfeld, Chief of Naval Operations, United States Navy;

Thomas J. Watson, member of Council, American Ordnance Association;

Gen. Omar N. Bradley, Chairman, Joint Chiefs of Staff;

Charles E. Wilson, member of Advisory Board, American Ordnance Association;

Hon. Francis P. Matthews, Secretary of the Navy;

Herbert A. Gidney, vice-president, American Ordnance Association;

Colonel Johnson, Secretary of Defense of the United States;

Colonel Walsh, president, American Ordnance Association;

Hon. W. Stuart Symington, Secretary of the Air Force;

K. T. Keller, director, American Ordnance Association;

Hon. Archibald S. Alexander, the Assistant Secretary of the Army;

Hon. Bernard M. Baruch, Chairman, War Industries Board, 1918;

Gen. J. Lawton Collins, Chief of Staff, United States Army;

C. Jared Ingersoll, director, American Ordnance Association;

Adm. W. H. P. Blandy, Commander in Chief, Atlantic Fleet, United States Navy;

Major Comeaux, president, New York Post, American Ordnance Association;

Gen. Clifton B. Cates, Commandant, United States Marine Corps;

Joseph L. Auer, chairman, Dinner Committee;

Maj. Gen. Everett S. Hughes, Chief of Ordnance, United States Army;

Reverend Dr. Trexler, student pastor, Muhlenberg College;

Vice Adm. Donald B. Duncan, Commander, Second Task Fleet, United States Navy;

Ferdinand Eberstadt, member, Hoover Commission;

Maj. Gen. Richard C. Coupland, Director of Armament, United States Air Force;

DeWitt C. Ramsey, president, Aircraft Industries Association of America;

C. K. Davis, member of Council, American Ordnance Association;

E. R. Godfrey, member of Council, American Ordnance Association;

Frank K. White, member, New York Committee, American Ordnance Association;

Herbert W. Alden, member of Advisory Board, American Ordnance Association;

Gen. Wade H. Haislip, Vice Chief of Staff, United States Army;

Brig. Gen. E. L. Ford, Chief of Ordnance Designate, United States Army;

Maj. Gen. James H. Burns, special consultant to the Secretary of Defense;

Rear Adm. Walter S. DeLany, Commandant, Third Naval District;

Robert L. Biggers, member of Advisory Board, American Ordnance Association;

John M. Olin, member of Advisory Board, American Ordnance Association;

Frank M. Folsom, president, National Security Industrial Association;

Thomas F. Brown, member of Council, American Ordnance Association;

Maj. Gen. James D. McIntyre, Director of Legislative Liaison, Department of Defense;

Donald F. Carpenter, Chairman, Munitions Board, 1948-1949;

Lieut. Gen. LeRoy Lutes, Commanding General, Fourth Army;

Maj. Gen. F. L. Parks, Chief, Public Information Division, Department of the Army;

A. W. Herrington, member of Advisory Board, American Ordnance Association;

R. K. Christenberry, president, Hotel Astor;

Maj. Gen. James Kirk, Office of the Chief of Ordnance.

MEMBERS OF THE NEW YORK COMMITTEE were: Thomas J. Watson, *chairman;* Julius Ochs Adler, Donald Armstrong, Mr. Auer, Preston R. Bassett, Col. Brown, Oliver E. Buckley, Curtis E. Calder, Major Comeaux, Ruth M. Cousens, W. A. Davidson, Myron E. Doucette, Crosby Field, R. E. Gillmor, N. H. Gilroy, Edward Gluck, J. M. Gruitch, Arnold Hanger, Charles J. Hardy, S. C. Hope, George R. Hussey, Jr., Carl W. Keuffel, H. T. Luria, J. T. Mackey, D. Blair MacMaster, R. L. Maxwell, James E. McNary, Thomas A. Morgan, Thomas E. Murray, Chester Mueller, J. G. Phillips, James H. Rand, Jr., P. B. Scott, L. C. Stowell, Harry M. Tillinghast, A. E. Van Cleve, Philip D. Wagoner, Mr. White, and Mr. Wilson.

THE DINNER COMMITTEE under the chairmanship of Mr. Auer consisted of: Major Comeaux, Paul T. Cullen, Will Eisner, Justin A. Fitz, H. T. Luria, Major MacMaster, Chester Mueller, C. P. Ray, Lloyd W. Stearns, and V. J. Zaro.

All in all, this dinner-meeting goes down in the history of industrial preparedness in the United States as a milestone emphasizing the important rôle of the American Ordnance Association in bringing into close coöperation all elements of the Department of Defense and of American industry. For the past thirty years the Association has taken a leading part in this most important field. It stands ready to uphold the Department of Defense now as in the past.

• **A NOTABLE MEETING OF THE ORDNANCE FRATERNITY** in and near St. Louis, Mo., was held Wednesday afternoon and evening, October 15th at Scott Air Force Base, near Belleville, Ill. Col. Edwin B. Meissner, president of the St. Louis Post and also president of the St. Louis Car Company, presided.

The meeting committee consisted of: Granville A. Waters, chairman; William M. Akin, George W. Brown, Brig. Gen. J. F. McBlaine, Lieut. Col. J. D. Childs, William P. Gatley, Claude L. Harrell, Edwin F. Judge, Capt. R. P. Kauffman, Edwin B. Meissner, Wallace A. Morse, and Clyde H. Morgan.

The program was as follows: From 2:30 to 5:30 P.M. there were exhibits in Hangar No. 1 and flying demonstrations by the latest types of jet-propelled aircraft. A buffet supper was served from 5:30 to 6:30 P.M.

Following a short business meeting in the gymnasium at 6:45 P.M., the principal address was given by Maj. Gen. Richard C. Coupland, Director of Armament, United States Air Force. A goodly representation of members of the Association and their friends attended.

The officials of the St. Louis Post in addition to Colonel Meissner are: Mr. Morgan, vice-president; Mr. Morse, secretary; M. F. Hubbell, treasurer. The directors of the Post are: Mr. Akin, August A. Busch, Jr., Colonel Childs, Arthur G. Drefs, Adrian W. Frazier, Russell E. Gardner, Jr., Mr. Judge, Captain Kauffman, Spencer T. Olin, William M. Rand, Mr. Waters, and Charles P. Whitehead.

• **NEW OFFICERS FOR THE YANKEE POST** were elected on September 29, 1949. Many of them are well-known throughout the Ordnance fraternity for their unceasing interest and coöperation in all affairs of the Association. The new president of the Post is Col. L. J. Meyns, who before his retirement as an officer of the Regular Army, served for many years in positions of responsibility in the Ordnance Department. The other newly elected officials in addition to Colonel Meyns, who will also represent the Post on the National Council of the Association, are: Vice-presidents G. P. Slade, J. J. Brogan, H. A. Wansker; Secretary-Treasurer J. Turner; Directors J. P. Spang, Jr., T. H. West, R. N. Greenwood, C. F. Carlstrom.

• **THE ORGANIZED RESERVE** Research and Development Training Groups have been activated by the Army in centers of research throughout the country to promote a more active participation by professional scientist and Engineer Reserve officers in the Organized Reserve program, to obtain useful results from actual research accomplished in Reserve training, and to assure mobilization assignments which will fully utilize the talents of the scientist Reservists. This new Army Reserve activity has been developing since early 1948.

On August 27-28, 1949, a week-end Reserve Research and Development Conference was held at Fort Sheridan, Ill., under the sponsorship of Headquarters, Fifth Army. Over 250 Reserve officers of all branches of the service attended from nineteen Research and Development Groups in nine States of the Fifth Army Area. All these officers, except the Chicago group, were placed on active duty for the period and therefore received traveling expenses and pay allowances.

The 5008th Research and Development Group of Chicago acted as host unit. The unit commander, Col. Lars Sjodahl, Ordnance Reserve, was general conference chairman, and Lieut. Col. S. F. Musselman, Ordnance Reserve, was assistant general chairman. Lieut. Col. W. E. Steele, Ordnance Department, unit instructor, Chicago Suboffice of senior Army instructor for Illinois, was in charge of processing of visitors upon arrival and on departure.

The technical program included talks by representatives of the chiefs of the seven Army technical services explaining the current activities and interests of the service in research and development, talks by representatives of the Logistics Division, General Staff, describing the Government's interest in Reserve research and development work and the status and development of guiding policies, and a talk by a Navy representative advising of the Naval Reserve research and development activities being administered by O.N.R.

An inspirational address prepared by Dr. Karl T. Compton, Chairman of the Research and Development Board, was presented by Brig. Gen. R. W. Crichlow, Army secretary on the Board. The balance of the program was designed to enable various groups of officers to get together for the first time for discussions of mutual problems pertaining to administrative activities, regional activities, professional pursuits, and collaboration on research projects.

The conference gave a tremendous boost to the interest of the Reserve officer scientists and engineers and proved by common consent to be of considerable benefit to Organized Reserve activities. The conference was the first Army-wide meeting of research and development officers in the Nation. Since the conference in its entirety approached for the first time a technical society meeting, but within the military structure, it is hoped that it can become an annual affair in the Fifth Army. It is also expected that other armies will be able to profit by the Fifth Army's experience and hold similar conferences within their areas.

• **THE WORLD'S CHAMPION SCROUNGING OPERATION** is being run in Japan these days—and all through the Pacific—by Col. O. P. Winningstad, a faithful member of the American Ordnance Association.

According to Arthur Caylor in the *San Francisco News*, Colonel Winningstad and Ordnance are now engaged in gathering up rusted and rained-on war equipment from every place in the Pacific where the Americans landed, and turning it into bright, shiny, new jeeps, trucks, tanks, engines, and parts. From this rusted and ravished stock pile they are supplying every Army outfit in the occupation theater with weapons, transport, and motor parts—the bulk of really expensive military supplies.

Colonel Winningstad, who started the war on Lieut. Gen. John L. DeWitt's staff at the Presidio of San Francisco and is now Ordnance Officer of Lieut. Gen. Walton H. Walker's Eighth Army, looks upon this vast work of rejuvenating the Army's vast Pacific junk heap as "Operation Taxpayer."

His idea is to save money, and he is doing it—hand over fistful. Incidentally, he is teaching the Japs to help pull their own weight—which also helps. At the plant where he turns old engines into new ones, M. S. Silvey, an old Chevrolet hand, has installed the first production lines the Japanese ever saw.

One line handles jeep engines, another Dodge engines, and a third GMC engines. Japanese do the work, Americans supervise. The vast building where Mitsubishi used to build tanks—practically by hand—now turns out 4,000 engines every time Chevrolet turns out 10,000 engines. To quote from the *News* article:

• **EMIL GATHMANN, SR.**, inventor of the Gathmann gun which appeared prominently on the Ordnance horizon early in this century, died at his home in Baltimore, Md., August 23, 1949. He was a charter member of the American Ordnance Association.

A native of Chicago, Mr. Gathmann early in his engineering career was connected with the ordnance plant of the Bethlehem Steel Company at Bethlehem, Pa. In 1909, he took up residence in Catonsville, a suburb of Baltimore, and became president of the Gathmann Engineering Company and the Gathmann Research Laboratory. He held more than one hundred patents relating to various metallurgical developments.

He was recently honored by the American Society for Metal and was formerly national chairman of that society. He was also a member of the American Iron and Steel Institute, the Mining and Metals Society, and the Royal Society of Engineering of Great Britain. He was particularly active for many years in the field of naval ordnance, his numerous researches and patents covering fuzes, depth bombs, and related equipment for the national defense.

• **COL. HARRY BIRDWHISTELL JORDAN**, U. S. Army, Retired, an Ordnance officer of long and distinguished service, died at Norfolk, Va., on September 13, 1949. Born in Louisville, Ky., son of a Confederate Army captain, Colonel Jordan was graduated from the Military Academy at West Point in the Class of 1901. He was graduated from the General Staff School, the War College, the Army Industrial College, and the Artillery School. He served in the Office of the Chief Ordnance Officer, American Expeditionary Forces, in the First World War and, following that conflict, was Chief Ordnance Officer at Coblenz, Germany, in 1921.

He was in command of the Rock Island Arsenal during the period when that great Ordnance establishment was realigned for its present mission. As commandant of the Army Industrial College he was instrumental in helping bring that important institution to the high academic and professional standards for which it is noted. He retired from active service, February 29, 1940.

He was acclaimed for his work with the Army Industrial College as having brought that institution to a position "unique not only in this country but in the entire world."

• **JAMES E. TAUSSIG**, retired president of the Wabash Railroad and long a member of the A.O.A., died at St. Louis, October 3, 1949. At the age of seventeen he began his service to American railroads as a freight clerk in the office of the St. Louis Bridge and Tunnel Railroad. In the First World War he was Federal manager of the Wabash system during the period of Government control. Realizing the close relationship between adequate transportation and the supply of ordnance material in time of war, Mr. Taussig had a keen interest in the work of the American Ordnance Association and was of continued help in the furtherance of its objectives.

The Reserves

NAVY GETS JETS

In a move acclaimed by Naval Air Reservists throughout the country, the Navy announced that thirty-six of the latest type jet aircraft will be assigned to U.S.N.R. squadrons between September 30th and next March 31st. Twenty-four of the jets earmarked for Naval Reservists are McDonnell FH-1 "Phantoms," the Navy's first all-jet fighter. Introduced in 1945, the Phantom is in the 600-mile-an-hour class and is powered by two Westinghouse axial-flow turbo jets. The 12 additional jets for the Air Reserve are North American FJ-1 "Furies."

LADIES IN RESERVE

The WAC Reserve, authorized by the Eightieth Congress, is presently made up of 580 officers and 629 enlisted women, all assignable to noncombat-type Reserve units and attachable to combat-type Reserve units. The WAC Reserve offers opportunity for Reserve unit company commanders to get help in handling administrative problems and allows more time for actual unit training.

NAVY CORRESPONDENCE COURSES

The first of approximately 240 correspondence courses specially prepared for enlisted personnel of the Organized and Volunteer Naval Reserve will be available soon. Until such time as these courses are ready, the only enlisted personnel who are eligible for the approximately thirty officers' courses now available are chief petty officers and enlisted personnel who are under consideration for commissions.

QUALIFICATION RECORDS

The Army has announced details of a new plan giving up-to-date information on Reserve officers to be obtained from questionnaires and annual report of changes. Punch cards, based on evaluated information from questionnaires, will form an inventory of military occupational specialties, skills, educational qualifications, availability, and other vital information. The plan will aid in efficient use of officers in the Reserve Corps program, furnish essential data in making mobilization assignments, and obtain from officers expression of personal desires regarding assignment and participation in the O.R.C.

CERTIFICATION OF PAY ROLLS

Field reports to the Army show many unit instructors believe they must attend personally each inactive-duty training assembly in order properly to certify pay rolls. In most cases it is physically impossible for a unit instructor to attend each drill, and the unit instructor's certificate on the pay roll is designed to take care of this situation. The unit instructor is responsible, however, for correct pay-roll entries, based on personal knowledge or data supplied by the unit commander and instructor or sergeant instructor on duty with the unit. The ruling is not intended to indicate a lessening of the value and desirability of having the unit instructor present for drill when practicable.

DOCTORS

Professional qualifications being equal, the doctor with Reserve status will be given "every legitimate advantage" relative to rank over the newly appointed doctor upon recall and assignment. New Army Medical Department policy recognizes that Medical Department Reserve and National Guard officers assume certain obligations in accepting commissions and participating and should be rewarded accordingly.

AIR R.O.T.C.

The Air Force will establish R.O.T.C. courses at 17 more universities and colleges in 13 States during the coming fiscal year, in addition to continuing the Air R.O.T.C. training already being conducted at 110 institutions. Seven types of specialized instruction will be given at one hundred and twenty-seven schools, depending on the type of institution concerned, and including general administration and supply, aircraft maintenance, engineering, armament, communications, comptrollership, transportation, and air installations. No flying training will be given.

AGE-IN-GRADE

Ages established for retention of Reserve officers in the Active Reserve are: second lieutenant, 40; first lieutenant, 43; captain, 46; major, 51; lieutenant colonel, 55; and colonel, 60.

IDENTIFICATION CARDS

The Army, working with the other armed services, has developed a joint identification card for civilian-component members. National Guard and Reserve Corps officers will get cards first, enlisted men later. The cards will be engraved in two colors of red and will bear the modified Presidential seal on left of face and component seal on right of face, together with a photograph of bearer. Plastic lamination will protect the cards.

O.R.C. OVERSEAS

Reserve officers taking up residence in foreign countries, except in occupied areas, retain active status for one year after leaving the United States and are then placed on the inactive list. On return to the U. S., they may request return to the Active Reserve and will be restored to the active list for one year for observation, regardless of vacancies.

O.R.C. TRANSFER REGULATIONS

Officers of the Active Reserve, serving in combat units of regimental or similar level and below of the Infantry, Armored Cavalry, Coast Artillery Corps, Field Artillery, or Combat Engineers, who reach the maximum age-in-grade for such combat-type units, will be transferred to an appropriate administrative, technical, or staff position within the available vacancies in other units or positions in the Active Reserve. If no vacancies are available, they may apply for transfer to another section.

Officers assigned to T/O & E and T/D units of the Active Reserve who have reached the highest grade authorized for that unit, or for whom there is no vacancy in that unit to which they can be promoted or no vacancy in a similar unit to which they may be assigned, may be transferred, at their request, for administration, training, and possible consideration for promotion to a unit other than one of the mobilization troop basis, Officers' Reserve Corps.

Officers of the Active Reserve who become or who are determined to be ineligible or disqualified for retention therein will be transferred to the Inactive Reserve.

Officers of the Inactive Reserve may be transferred to and assigned in the Active Reserve at the discretion of the area commander, provided a vacancy exists and the officer submits a statement in writing that he is desirous and capable of maintaining an active status. Transfers from the Honorary Reserve to the Active or Inactive Reserve are not authorized.

RESERVES TRAIN WITH REGULARS

Army commanders have been authorized to place on active duty for basic training with Regular Army training divisions enlisted Reservists without prior military service, within limits of the funds available for Enlisted Reserve Corps training.

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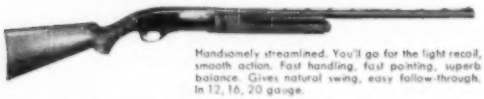

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Atomic Energy

ATOMIC ENERGY COURSE

An orientation course on all military phases of atomic energy is being given commanders and staff officers of Army commands in the United States and overseas. The courses are conducted by Armed Forces Special Weapons Project teams composed of Army, Navy, and Air Force officers who are specialists in the field of atomic energy. The orientation courses, which began August 24th, will be given through December 9th at the various command headquarters. These include six army areas in this country and six overseas commands.

The program for Army officers attending the course will include: organization and military application of atomic energy, atomic-bomb effects, medical aspects of atomic explosions, radiological defense and radiological defense logistics, and atomic power development. Conducted in 2 sessions of 3½ hours each for a total of 7 hours, the course will be given over a 2-day period. The program constitutes one phase in a series of atomic orientation courses which will ultimately be extended to all Army troops.

GREATER ATOM SMASHER

A 70,000,000-volt synchrotron, one of the newest atom smashers, will be brought into the fight against cancer in 1951. Such a machine has been ordered for the University of California Medical School at San Francisco and will be financed by the Atomic Energy Commission. It will be constructed by the General Electric Company.

The machine will be used to explore thoroughly the indications that very high energy radiations go through normal tissue without doing much harm to them and have nearly all their effect deep in the body, according to *Science News Letter*. Experiments with X-rays up to 20,000,000 electron volts have already shown that this happens. Scientists feel that this principle offers great promise in the treatment of deep-seated cancers, in which one of the main problems is to destroy the cancer without killing the normal cells.

ATOMIC DATA STUDIED

A trial program for examining selected declassifiable technological information in the field of metallurgy with a view to determining its possible value to American industry has been inaugurated by the Atomic Energy Commission. To assist in developing the program, a temporary advisory committee of representatives of professional societies and the business press has been appointed.

The purpose of the program is to determine the possibility of providing to industry information about pumps, blowers, valves, techniques of handling metals, and other data which will be of immediate value to industry. The trial program will determine whether such selected information can be gathered, screened, and declassified for release in a way which will not reveal the specific relevance of the information to the atomic-energy program.

The setting up of the advisory committee is the first step. This group will recommend members for a small working party of engineers, representatives of professional societies, and members of the business press in the field of metallurgy who will receive full security clearance. After the working-group mem-

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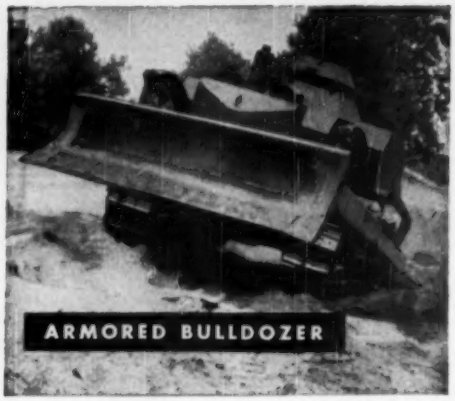

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bers are cleared, the Commission will make available for examination by the working party metallurgical information which may be declassifiable.

From the information made available to it, the working party will recommend to the Commission those portions which it believes should be considered for declassification because of their usefulness to American industry and technology. The Commission will exercise, of course, the final responsibility for declassifying any recommended material, taking into account the considerations against declassification as well as those favoring declassification.

Any information which the Commission may actually declassify would be made available for publication by established engineering and industrial journals in the field of metallurgy. If the trial program in metallurgy proves effective, the Commission will consider the application of similar procedures to other fields of technological and industrial information.

The trial program is in response to the 3-part recommendation of the Commission's Industrial Advisory Group that: (1) Already published material should be organized and clarified and reports issued in a form useful to industry; (2) Unpublished information of nonrestricted nature should be made available to industry in useful form; and (3) Information still classified, but properly declassifiable and of special interest to industry, should be surveyed and declassified.

MATERIALS-TESTING REACTOR

The Atomic Energy Commission is negotiating with the Chemical Plants Division of the Blaw-Knox Construction Company, Pittsburgh, Pa., for a contract covering architect-engineer services for the engineering design of a materials-testing reactor.

Architect-engineer work to be performed will include the engineering design of the reactor and the preparation of detailed specifications and cost estimates.

Research, development, and preliminary design of the reactor was begun in 1946 at the Oak Ridge National Laboratory, Oak Ridge, Tenn., and for the past half year has been carried on jointly by the Oak Ridge Laboratory and the Argonne National Laboratory, Chicago, Ill. The architect-engineer will work closely with these two laboratories.

Primary purpose of the new reactor will be to test various reactor construction materials under intense neutron bombardment. This will be of an intensity very much greater than any ever experienced before, even in the large production reactors at the Hanford Plutonium Works, Richland, Wash.

The materials-testing reactor will provide the Commission with a powerful new tool for the furtherance of the whole reactor-development program. Principally, it will be a means for testing fuel and structural materials under the severe conditions of temperature and radiation which will be encountered in the power reactors of the future. The new reactor will therefore play a vital part in the development of atomic plants for the production of power and atomic engines for the propulsion of ships and possibly aircraft.

The new reactor will also provide an intense source of neutrons for use in experiments in nuclear physics.

NEW ADVISORY COMMITTEE

The U. S. Atomic Energy Commission has formed a 3-man temporary advisory committee to recommend ways to establish continuing cooperation between the electric power industry and the A.E.C. It is expected that the committee will study the Commission's reactor program with a view to identifying areas or potential areas of mutual interest to the electric power industry and the Commission and make recommendations for bringing about a continuing program of cooperation in these areas.

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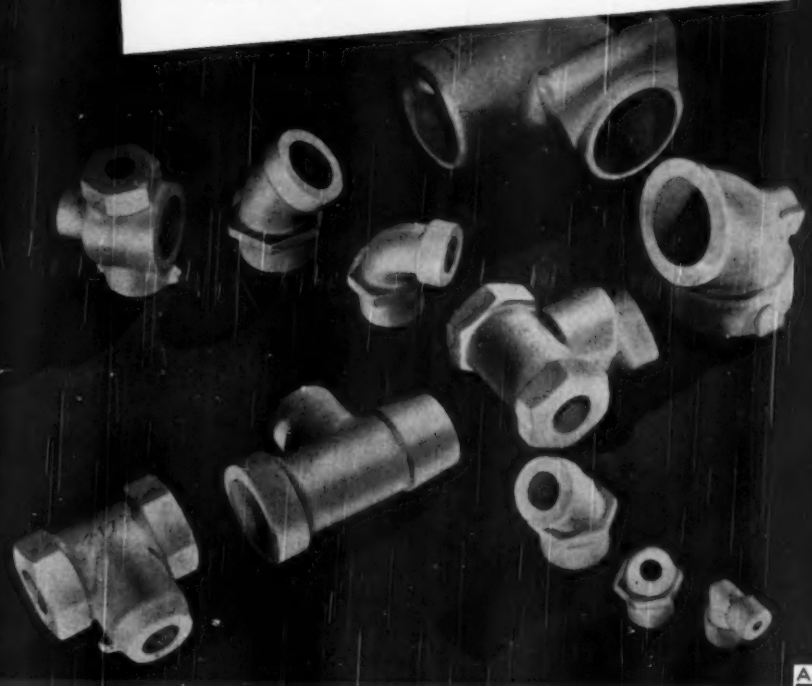

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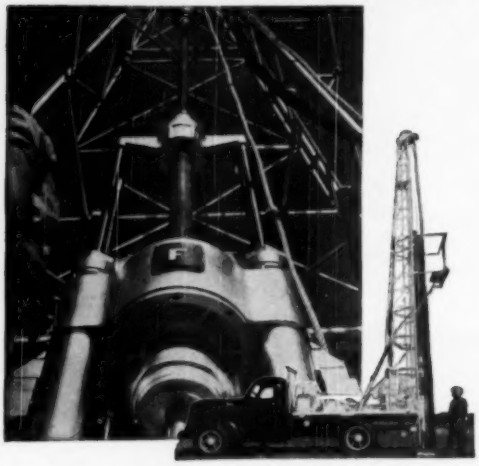

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Book Reviews

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COL. PHILIP SCHWARTZ, *author, air ordnance expert, Headquarters, United States Air Force, Washington, D. C.*

Strategic Air Power. By Stefan T. Possony. Washington: Infantry Journal Press. 313 pp. $5.

DR. POSSONY is peculiarly well qualified as a competent student of strategy and military history to examine the present and prospective rôle of air power in national defense. His book is an objective and conscientious study of strategic bombing, without a trace of the "Sunday-supplement" sensationalism that frequently detracts from the too-enthusiastic claims in support of air power.

Looking back on the recent war he concludes: "Superiority in the air has become the prime condition for effective application of land and sea power. Yet air power alone did not win World War II. This war was planned to be won by triphibious power, and by triphibious power it was decided." Looking ahead he holds that "the survival of democracy is assured only if the democratic nations hold their dominion over the air."

In no earlier book has strategic bombing in World War II been more effectively analyzed. The experience of the war proved that the most profitable targets to destroy were the power plants and transformers, transportation systems and factories. Civilian morale was not destroyed by bombing to the degree anticipated.

The inevitable conclusion reached by Dr. Possony is that "air power is the master weapon of the industrialized society," and air power may be capable of winning victory as an independent strategic weapon.

The author is careful to consider both the economic and military aspects of bombing. In consequence his book should appeal strongly to the readers of ORDNANCE. It deserves to be widely read in this country and, fortunately, it can be readily understood by the layman for it is written simply and clearly. The reader will understand better how air power contributes to the maintenance of peace and to victory if war comes.—DONALD ARMSTRONG.

Peace or Pestilence. By Theodor Rosebury. New York: Whittlesey House. 218 pp. $2.75.

THE scope of the book is given by its subtitle, "Biological Warfare and How To Avoid It." Dr. Rosebury was chief of the

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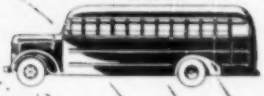

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Book Reviews

Airborne Infection Project at the United States Biological Warfare Headquarters, Camp Detrick, Md., during World War II, and is eminently fitted to write this book on the subject of biological warfare (BW).

He first reviews bacteriology in everyday language. Then he introduces BW as "bacteriology upside down"—an inversion of nature. Whereas bacteriology is the study of diseases to prevent them, BW produces diseases, either natural or artificial, that can be used as effective weapons in war. The potency of various BW agents, the means and methods of production, and their use as offensive weapons are covered at some length. There is no attempt to ascribe to BW the title of universal agent of destruction that is often attributed to new and little-understood weapons.

True, it is a deadly form of warfare. The agents can be produced cheaply and without much equipment. Distribution is simpler than is the case for most any other weapon. However, to obtain effective coverage and to affect large groups of the population simply, quickly, and continuously is not easy.

Defense is possible, and nullification of the effects of the agents can be accomplished easily. Contaminated water supplies are soon discovered and neutralized. Airborne BW agents are not easily controlled by the aggressor and possibly would not be used.

By sound, well-chosen arguments, the author removes the horror and the aspect of utter helplessness in the face of BW agents, and gives a true factual picture of this new form of warfare. Its potentialities, and the possible extent of its use are forecast. He is very positive regarding the desirability of international control of BW, along with the atomic bomb. His chapter entitled "The Larger Problem," *i.e.*, peace rather than war, is excellent.

He brings out an interesting point regarding the use of medical men to conduct the research on BW, in effect using their talents to discover agents to cause disease and cripple people rather than performing their avowed work according to their Hippocratic oath of saving life and healing.

"Peace or Pestilence" is a very interesting book and is recommended to military and civilian reader alike. It disarms the apprehensive and gives hope for the future.—THOMAS K. VINCENT.

The Army Air Forces in World War II. Volume II: Europe —Torch to Pointblank (August 1942 to December 1943). Edited by W. F. Craven and J. L. Cate. Chicago: The University of Chicago Press. 897 pp. $6.

IN these days when people in and out of uniform, as well as writers in newspapers, magazines, and books discuss voluminously the characteristics and potentialities of future warfare, a work of this sort is timely. Although written from the point of view of one who probably believes that air warfare was of primary importance in World War II, its approach is sufficiently impartial and supported by enough wartime official letters and memoranda that even those who doubt the importance of aërial warfare will find the book the most valuable one which has appeared thus far on its subject.

The man who is interested in ordnance will find much of interest in the book. It discusses the value of the various kinds of bombs used against European targets and goes into the question of accuracy of visual and radar bombing. It discusses the value of the guns and turrets of bombardment aircraft and points out that bomber gunners did not always shoot down enemy fighters and that escort fighters probably protected our bombers more than bomber guns. It discusses the relative effectiveness of German fighters and antiaircraft guns against our bombers. For the period under consideration, German fighters caused many more casualties among our bombers than did German antiaircraft guns.

THE AMERICAN ORDNANCE ASSOCIATION

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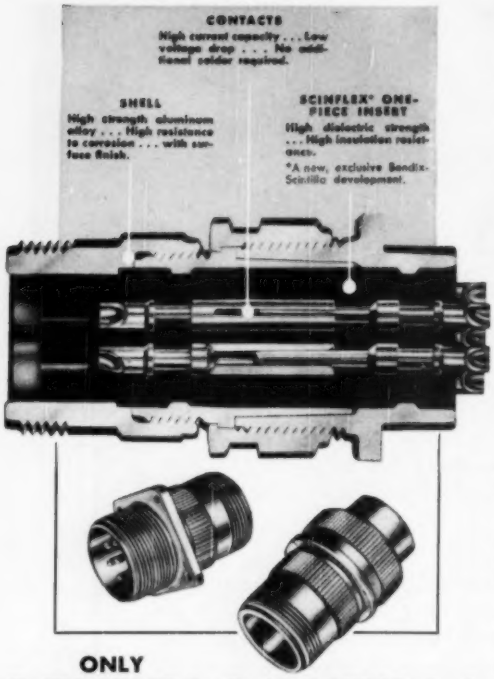
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If the other volumes of this series of seven are as reliable as this one, it should become a most important reference for all who wish to predict the nature of the next war by reading the history of the last one.—PHILIP SCHWARTZ.

Nineteen Eighty-Four. By George Orwell. New York: Harcourt, Brace & Company. 314 pp. $3.

ANY person who enjoyed the writings of Jules Verne several decades ago and has seen his fantasies become realities will read this book with just a little apprehension. It is grim, stark, horrendous reading, but interesting and gripping nevertheless.

In 1948, the period in which the action of this novel occurs, the world comprises only three large groups: Oceania, which embraces the Americas and England; Eurasia, which consists of Russia and her allies; and Eastasia, which is the remainder of the world and with which one or the other two groups is constantly at war. Oceania, with which the story deals, is ruled solely by Big Brother and the Party, with resemblance to the modern dictator pattern raised to the *nth* power.

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The Conquest of Space. By Chesley Bonstell and Willy Ley. New York: Viking Press. 160 pp. $3.95.

THE scope and imagination projected in this book, all supported by scientific fact, is truly a visit into the future. Based on what technical and research scientists have proved to be facts, Willy Ley, well-known authority on rocket propulsion, opens graphically the universe that our children may some day visit.

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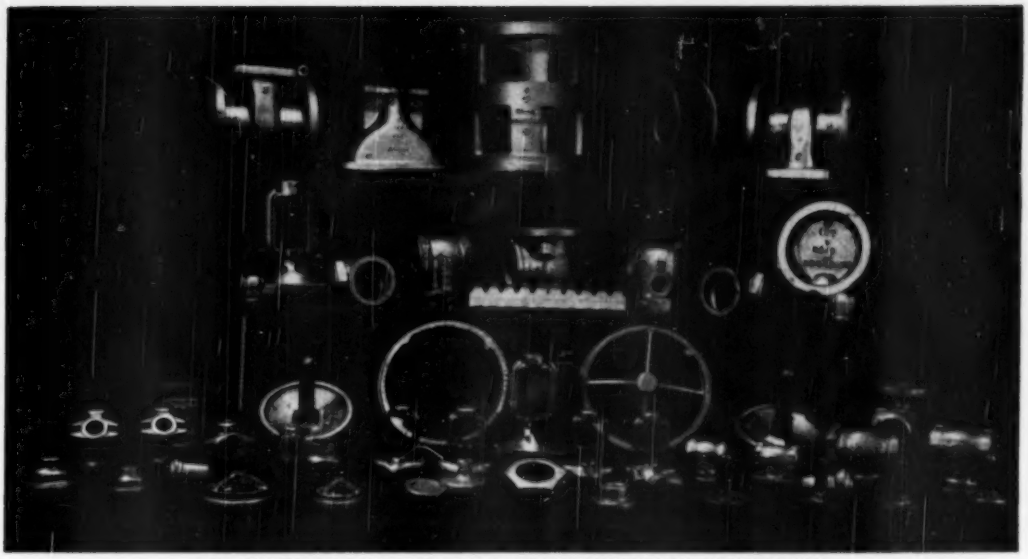
The incredibly graphic paintings and drawings of Chesley Bonstell are the outstanding feature of this book. He shows what it looks like to see Saturn from its satellite "Titan," and the view from the rim of the crater "Theophilus" on the Moon, with almost photographic realism.

It is probably the first authoritative work for the layman that approaches the question of space travel with cold, unemotional, and unimaginative facts. This is probably the first introduction to a world of travel that, in the relative sense, will soon be commonplace.—PETER FIELD.

Mathematics for Industry. By S. E. Rusinoff. Chicago: American Technical Society. 518 pp. $5.50.
Strength of Materials. By C. O. Harris. Chicago: American Technical Society. 212 pp. $4.90.

FOR the factory man, the designer, and the engineer, "Mathematics for Industry" is a practical and logically developed textbook, and it forms a quick reference for those already familiar with mathematics through trigonometry and logarithms.

"Strength of Materials" is a practical continuation of "Mathematics for Industry." It begins with the simplest problems of forces and equilibrium and treats of the methods of calculation of stresses in various mechanical forms. The book is highly illustrated with line cuts of practical problems, and it reduces the mathematics of mechanical construction to as simple a form as can be expected in this science.—GEORGE STUART BRADY.



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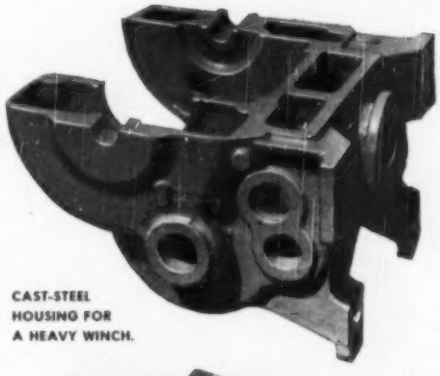

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Book Reviews

The Epic of American Industry. By James Blaine Walker. New York: Harper Brothers. 513 pp. $5.

THE main theme of the author in this volume is that the narrative of business is not one of merely sustaining existence but rather of an impelling desire for an ever-rising scale of living. Contrasting the grinding and almost hopeless toil in Europe with the chance for the free development of life in the America of Colonial times, the author begins with the unfolding of manufacturing in the Colonies and narrates the story of the railroads, the canals, mining, agricultural machinery, steel, the electric age, the automobile, and the other inventions of this fast-moving, scientific age.

In between, he gives lucid and interesting discussions of the finance that made big things possible. One sees Rockefeller, Harriman, and the other giants of finance, not as ruthless monopolists, but as daring expansionists who opened up vast territories and believed that big, concentrated production could bring low-cost products to the multitude.

The author also shows how the overstepping of competitive bounds by the great corporations gradually brought government into business controls. Considerable space is given to how the great industrial free-enterprise system that had been built up in America mobilized for a war effort that needed tremendous mechanical production, but how, in doing so, it permitted more and more socialization and loss of free action.

The author's original theme comes back in retrospect in a final chapter which asks the fundamental question as to whether this generation can now muster the moral and spiritual strength to direct the scientific and economic orders which we have devised. On one side we have become vitally aware of the weakness in our complex industrial system that swings from high prosperity to low depression with attendant acute distress. On the other side the peoples of the world are being offered an alien hostile philosophy that promises abundance to all if men will yield their freedoms and their liberties to an all-powerful state.

The profit motive and the recognition of the inalienable personal rights of the individual are the things that made America great. The author believes that a solution for the lack of stability cannot be found in the new doctrines of socialization but that we must renew the original spiritual strength of our forefathers and at the same time acquire a new enlightenment that will look beyond individual and group striving to recognize more clearly the common good.—GEORGE STUART BRADY.

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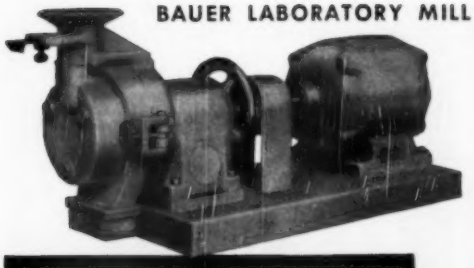

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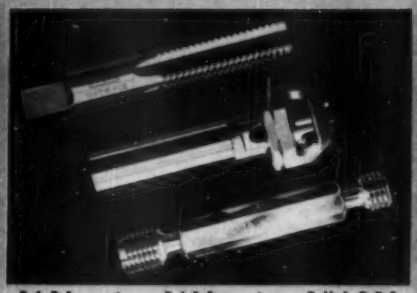

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The Index to Volume XXXIII of ORDNANCE, with title page for binding, is now available. It will be sent free of charge upon request to the Editorial Offices at the address below.

It covers subjects in the following 1948 and 1949 issues: July-August (No. 169), September-October (No. 170), November-December (No. 171), January-February (No. 172), March-April (No. 173), and May-June (No. 174). It is arranged alphabetically by subject and author.

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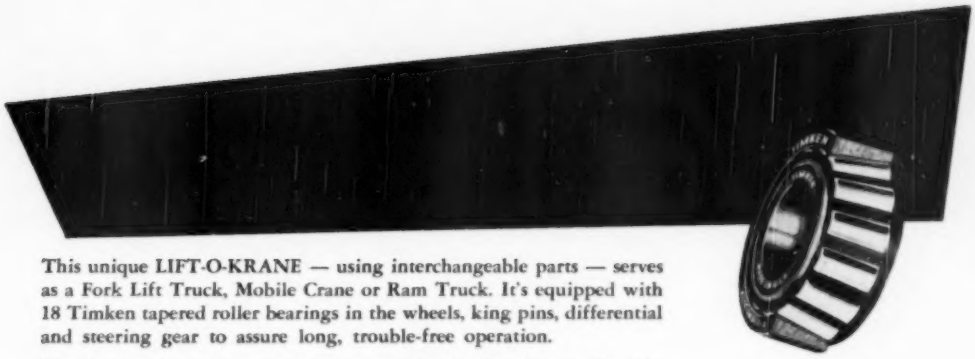

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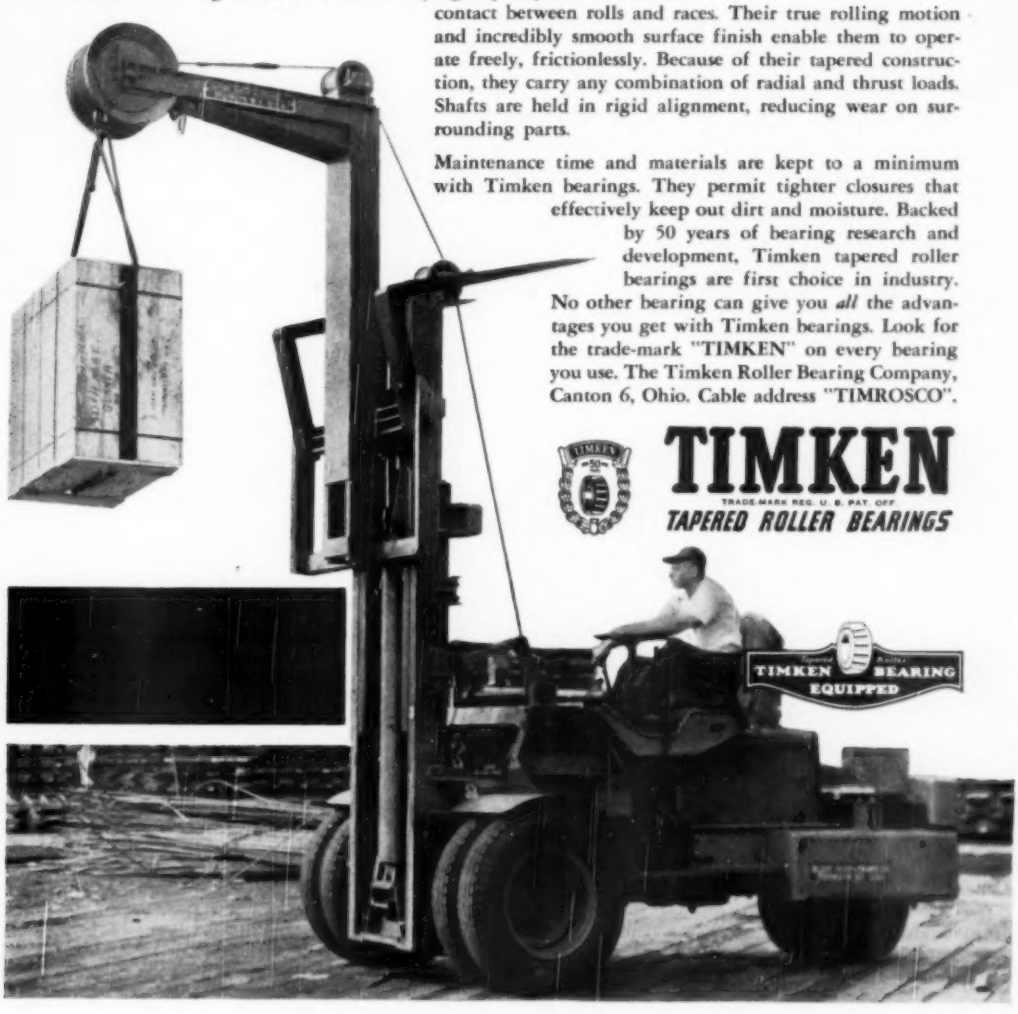

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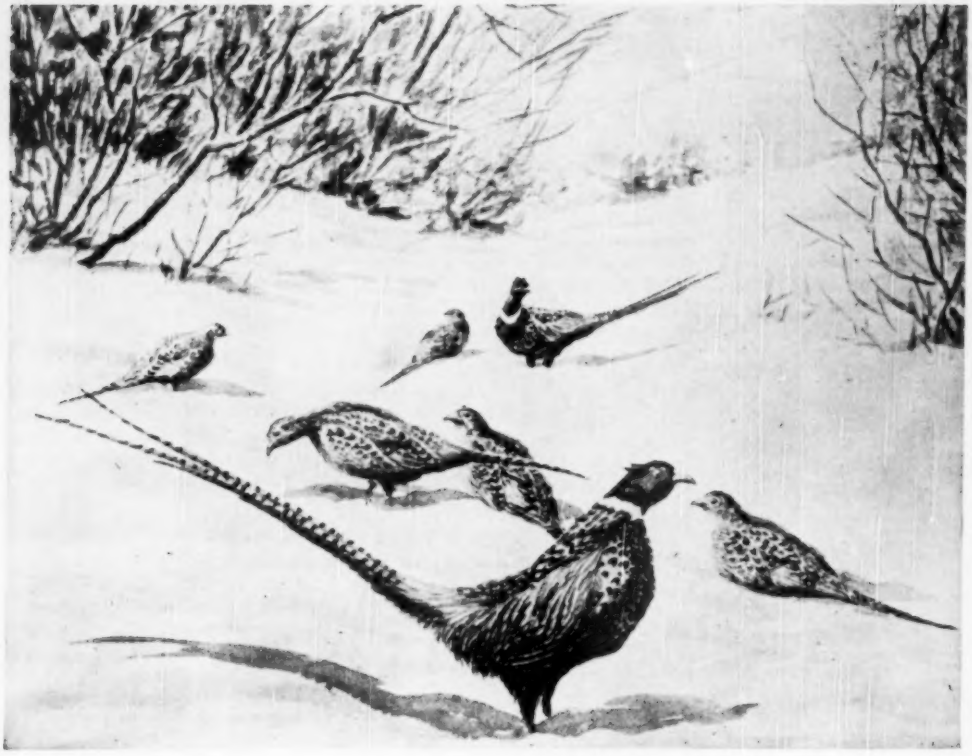

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by Hans Kleiber

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